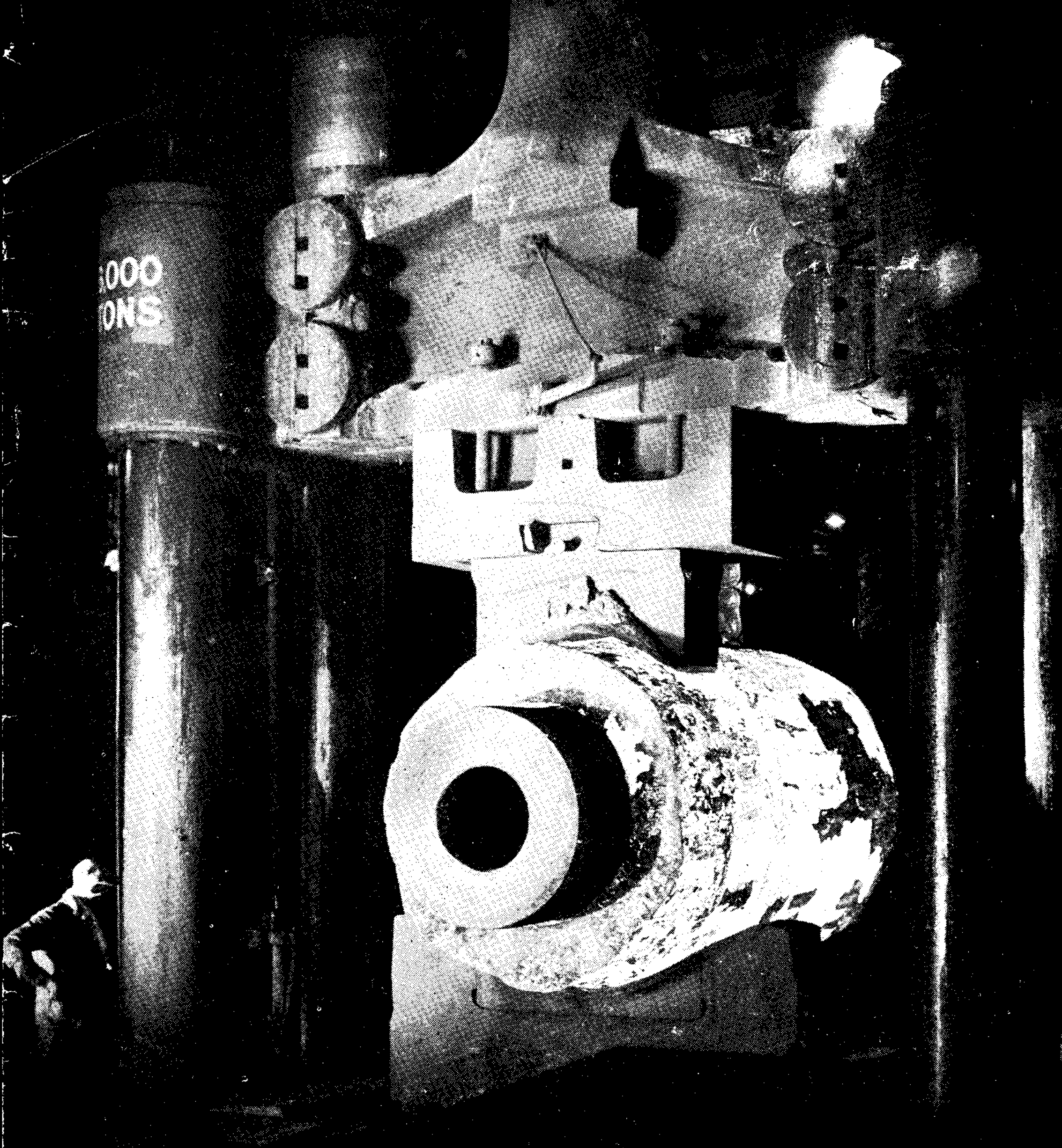
THE MODEL ENGINEER

Vol. 97 No. 2410 THURSDAY JULY 31 1947 9d.



The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

31ST JULY 1947 VOL.97.NO.2410

SMOKE RINGS

Our Cover Picture

● FOR our illustration this week, a 6,000 ton press, we are indebted to Messrs. Thos. Firth and John Brown Ltd., of Atlas Works, Sheffield. This press can shape masses of steel several feet in diameter and weighing more than 200 tons by exerting a pressure of about 6,000 tons. With its auxiliary cranes, rotating gear and other tools for manipulation, it is an exceptionally large example of the hydraulic intensifier press. Two or more furnaces have to be worked simultaneously in order to supply a sufficient quantity of molten metal to make the large ingots for this press. Perfect synchronisation of operations is vital throughout, calling for a specialised metallurgical and manipulative technique. Owing to the great size of the completed forging, exceptionally long heat-treatment cycles are employed. Considerable precautions are taken to prevent the setting up of unduly high internal stresses due to differential cooling. The Firth-Brown 6,000 ton press has forged machinery for some of the most famous vessels afloat, including the *Queen Mary* and *Queen Elizabeth.*

A Collector of Tools

● IN the monthly letter of the West Riding Small Locomotive Society, a member relates how when, accompanied by his wife, he was making some purchases at a tool dealers' shop, the assistant said to the wife, "I suppose your husband is a model engineer." "Oh! no," she replied "he is only a collector of tools for his workshop!" The hint was effective, and the tools have since been put to an appropriate use. I am glad to hear that the Society's track at Blackgates is practically completed, thanks to the devoted work of a number of the members. A small section of the track, with drawings and photographs, will be an instructive feature of the loan section at the forthcoming "M.E." Exhibition.

The Result of a Challenge

● AN exhibitor in the Competition Section of our forthcoming exhibition tells me that his entry is the result of a challenge from a friend. The model in question is a fine scale model of the famous clipper ship *Cutty Sark,* and when the builder first expressed his idea of making such a model, his friend told him he did not believe he could do it. This challenge aroused a fighting spirit. "It took me three years to make it" he told me, "and here's the result." So saying he handed me a photograph of the completed model, obviously, a very fine job. The born model maker is a very difficult person to defeat. Tell him something is impossible, and he forthwith sets himself to work and does it. At any rate, I am sure that many fine models have been the outcome of a determination to overcome seemingly insurmountable difficulties

Two Corrections

● THE eagle eyes of readers are quick to notice misprints which, in spite of every care will sometimes occur in any printed journal, I am grateful to two readers who have written to correct slips of the pen that have made their unwelcome appearance in recent "Smoke Rings." From Toronto, Canada, Mr. A. S. Olver, writes :—"I was very pleased to see the cover of the issue for April 17th, with the very good likeness of No. 3100, as the Canadian *Pacific* motive power appeals most to my model-making activities ; but to see on the Editorial Page that credit was given to the C.N.R. was too much!" The description of the cover-picture referred to ascribed the engine to the Canadian National Railways, whereas she belongs to the Canadian Pacific Railway. In the June 12th issue, under the heading "South Coast Miniature Railways," I wrote of one at Southsea and two at Weymouth, stating that all these tracks will be engined and operated by David Curwen Ltd., of Baydon, Wilts. I have received a letter from Messrs. Baker & Bryden, of Hilsea Lido, Portsmouth, who state that Messrs. David Curwen Ltd., have supplied a $10\frac{1}{4}$-in. gauge "Pacific" locomotive to the order of Messrs. Baker & Bryden, who actually operate the miniature railway at Hilsea Lido. This is, itself, of some interest to our readers, in that it is practically "L.B.S.C.'s" "Hielan' Lassie" built three times full size. Through the courtesy of Mr. David Curwen, I am able to reproduce a photograph of the engine and to give particulars of the principal dimensions. The boiler is of $\frac{5}{16}$-in. plate, 5 ft. 5 in. long and $13\frac{1}{2}$ in. diameter ; it is pressed to 100 lb. per sq. in. working pressure. It is injector-fed, and the fittings include two water-gauges, a pressure-gauge, injector cocks, blower valve and whistle. Two "Pop" safety-valves were fitted, at first ; but they had to be removed because their explosive action was considered to be too frightening! The grate area is approximately 180 sq. in. There are two cylinders, 4 in. diameter by 5 in. stroke, with slide-valves operated by Baker valve-gear. The wheel diameters are : Bogie, 7 in. ; driving, $13\frac{1}{2}$ in., and trailing, 8 in. The tender is of L.N.E.R. standard 6-wheeled type, carried on 8-in. wheels. The total length of engine and tender is 13 ft. 6 in. I understand that a sister engine will shortly be going into service at Weymouth, together with two $10\frac{1}{4}$-in. gauge L.N.E.R. 2-6-2 engines of similar specification, except that the boilers will be shorter.

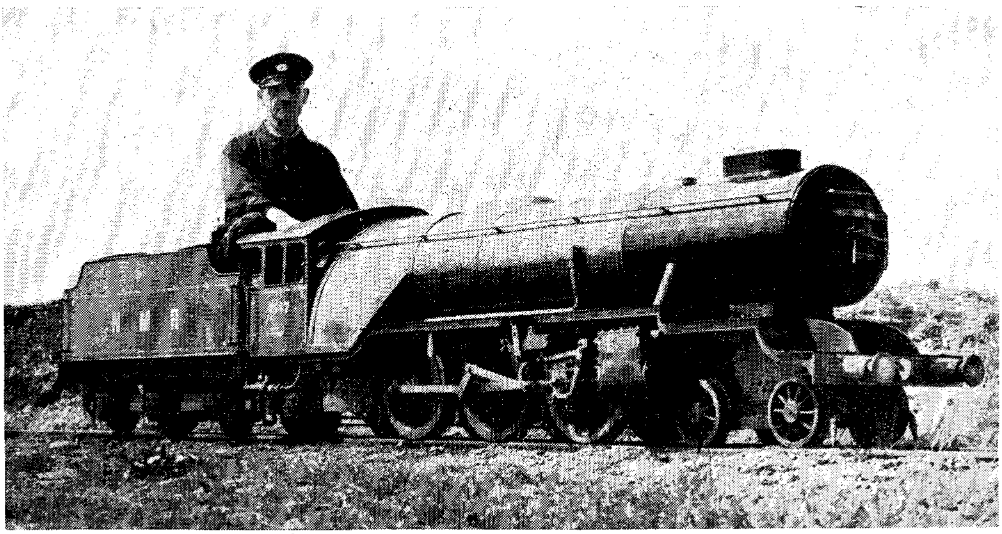


Photo by courtesy] [*Evening News, Portsmouth*

The Hilsea Lido miniature railway locomotive

A Ramsgate Revival

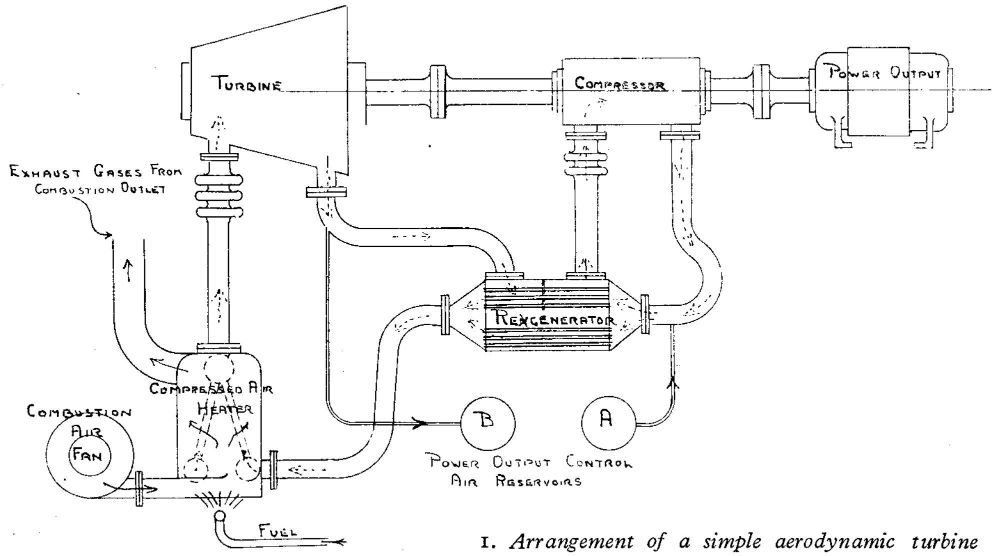
● DURING the war years a modest effort was made to form a model club for Ramsgate and district. Conditions then were so disturbed that no definite organisation resulted. I am glad to hear, however, that a fresh start has been made under much more promising auspices. Air Commodore Boswell has kindly consented to serve as President and Mr. Gutteridge, to whose enthusiasm the initial steps have been due, is acting as Hon. Secretary. His address is, The County Works, Dumpton Park Drive, Ramsgate. A small exhibition was staged on July 22nd to serve as a get-together occasion, and correspondence or a personal visit will be welcomed by Mr. Gutteridge at the address given.

Percival Marshall

THE AERODYNAMIC TURBINE

by A. H. Poole, A.M.I.Mar.E.

ENGINEERS have almost achieved the greatest possible efficiency in the design of steam engines, the trend has been from the earliest designs to increase pressures and temperatures, but there are obvious limits to this increase. The insurmountable weakness of steam engines as we know them, is the fact that such a large proportion of the total heat imparted to the water in the boiler is lost in the circulating water which makes possible a high vacuum in the condenser. Various methods have been put to use to make the steam capable of doing more work before its ultimate condensation. These methods usually take the form of inter-stage reheating, that is, after steam has exhausted from a high pressure turbine, it is heated before passing to the lower pressure turbine. There may be several stages of reheating before the final condensation of the steam. An alternative idea practised, is to compress exhaust steam from the high pressure stage, before passing to the next expansion range. All these additions to the simple turbine layout have been methods of delaying the inevitable loss when steam is converted in the condenser to water. In a further effort to reduce cooling water losses in heat, other mediums of operating plant than water have been tried. One effort used mercury, which after doing work in the turbines, heated water to steam for further work. The plant to be described, uses air as a medium to convert heat energy into useful work, this engine called the aerodynamic turbine is very similar to the ordinary steam turbine plant, except that the process of condensation is eliminated. This means that after causing a turbine to rotate the air is compressed and reheated, and so made available to recommence the cycle again.



1. *Arrangement of a simple aerodynamic turbine*

Before going on to describe the plant it must be realised that there are two separate air systems. One is the system already mentioned, which operates the turbine and is entirely closed, that is, the same air is used continually and does not come into contact with the atmosphere. The second air system is that which is necessary to burn the fuel used. The engine essentially consists of a compressor, heat exchanger, air heater and turbine. Compressed air in storage tank *A* in Fig. 1, passes through the heat exchanger, or regenerator, as it is sometimes called, and then to the air heater where the temperature is raised to about 1,200 degrees F. It next enters the turbine and expands, so driving the rotor, which in turn drives the compressor which raises the pressure of the turbine exhaust to the original pressure, and so to the air heater again. The power developed is obtained when the heat gained by the compressed air in the air heater is expended in driving the turbine. The regenerator increases the thermal efficiency by utilising the remaining heat in the exhaust from the turbine to raise the air temperature on leaving the compressor. Arrangements of plant can consist of several stages of turbines, say a high pressure, intermediate pressure and a low pressure turbine, and by compressing the air in stages, the efficiency of compression can be increased by cooling the air between stages and so reducing the volume of air to be handled by the next stage compressor. Fuel oil is burnt in the air heater by means of a

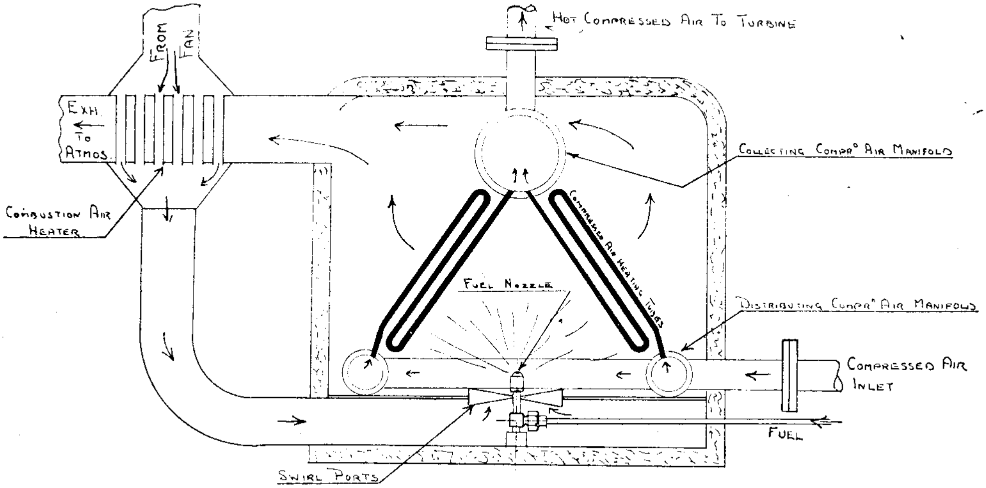


Fig. 2. Diagrammatic view of compressed air heater

high pressure fuel atomiser, spraying into a steam of air from a forced draught fan. As an additional aid to good combustion and efficiency, the combustion air is preheated by exhaust gases from the burnt fuel. Thus we have the two air systems.

Control over the power developed is obtained by varying the amount of fuel supplied and by increasing or decreasing the amount of air circulating in the compressor, air heater and turbine system. This is achieved by the use of storage tanks.

The main units of the engine can now be discussed in further detail, the compressor is of the rotary type and usually of the displacement variety, another plan is to use a type of design which looks roughly like a turbine; but is actually compressing a gas instead of that gas expanding and so driving the rotor. The heat exchanger or regenerator is a comparatively simple arrangement, whereby compressed air from the compressor is heated as it passes through tubes, which are placed in the exhaust air stream from the turbine. Thus heat remaining in the turbine exhaust is saved and passed to air on its way to start the cycle again in the air heater. This last mentioned unit is shown in more detail in Fig. 2, its function being similar to that of a boiler, except that heat is passed to compressed air instead of water. The compressed air circuit is shown in solid black lines and it can be seen

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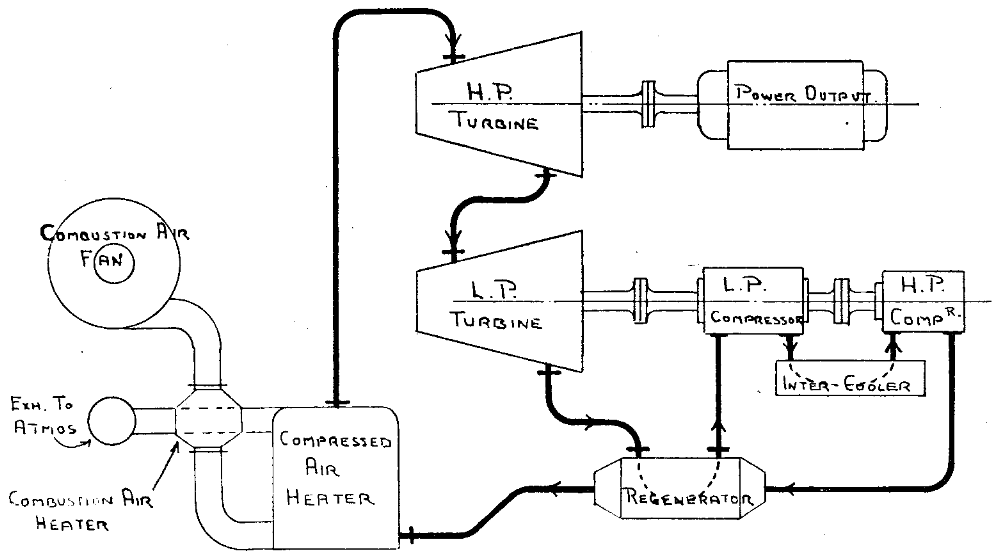


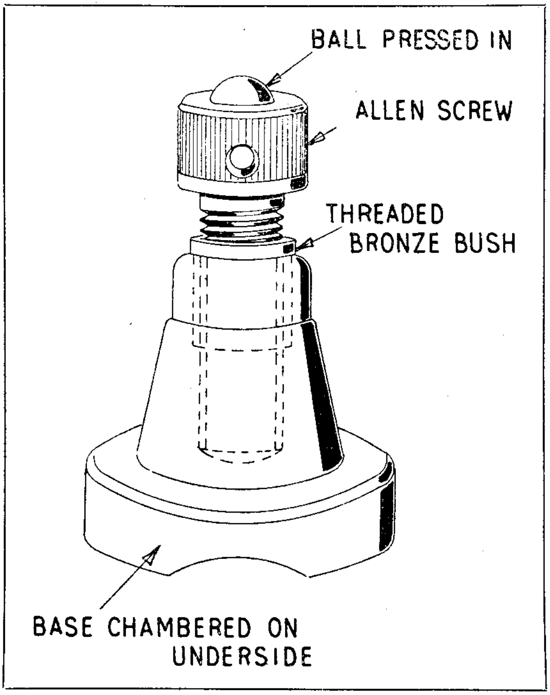
Fig. 3. Diagrammatic arrangement of multi-stage plant

A SIMPLE SCREW JACK

by Ian Bradley

MODEL engineering friends who have seen the various examples and sizes of screw jacks which I have made from time to time, have suggested that this is just the kind of thing for which people are looking, as they are simple and quick to make and very handy when finished. As will be seen from the sketch, the jackscrew itself is a standard Allen screw into the head of which a hardened steel bearing ball is pressed. As most readers will be aware, Allen screws are provided with hexagonal recesses in their heads to receive the key necessary for turning them. It so happens that this recess, in all practical sizes of screws, is of the right diameter to take a standard steel ball as a press fit.

The jack shown in the illustration is one of a pair I made some years ago for adjusting the position of large drop forgings on the marking-off and view-room tables. It will be observed that the jackscrew works in a bronze bush. This is of material help when handling very heavy work, as it permits the screw to turn more readily, but it is scarcely necessary for the lighter work encountered in the model engineer's shop.



The jack in question has a screw $\frac{1}{2}$ in. dia., threaded B.S.F. and a $\frac{3}{8}$ in. ball is pressed into its head. For the small shop jacks half this size, i.e., $\frac{1}{4}$ in. screw and 3/16 in. ball, will be found more convenient. Detailed drawings do not seem necessary, as all dimensions may be scaled from the illustration which is slightly less than full size.

If any reader makes up the larger jack, it is advisable to drill the tommy-bar hole as shown in the drawing, as the provision of this is important when handling heavy work. It may be necessary to let down the Allen screw before drilling, as some forms are hardened.

The Aerodynamic Turbine

(*Continued from previous page*)

that the air enters the bottom of the heater in two manifolds ; it then passes up the smaller tubes and thence into the outgoing manifold, and so to the turbine. Fuel is injected in a fine spray, air being supplied from a fan which forces air into an exhaust gas heater, through some trunking and finally through swirl ports to reach the atomised fuel. The exhaust gas heater mentioned here obtains the necessary heat to raise the temperature of the combustion air from the exhaust gas products of this combustion.

The turbine is usually of the impulse type, revolving at a speed somewhere in the wide range of 3,000 r.p.m. to 8,000 r.p.m. As mentioned previously there may be several stages in the expansion of hot air, Fig. 3 shows such an engine arrangement. In this instance there are two turbines, a high pressure and a low pressure machine ; one drives a generator and the other the compressor. Compression of air is also carried out in two stages, between these stages there is an inter-stage cooler to reduce the volume of air handled in the second stage. The drop in temperature of the partially compressed air in this cooler causes the volume of air to contract.

Throughout the engine special measures are taken to limit and control expansion. In places subject to high temperatures, for example the turbine, special steel of a nickel-chrome species is often used.

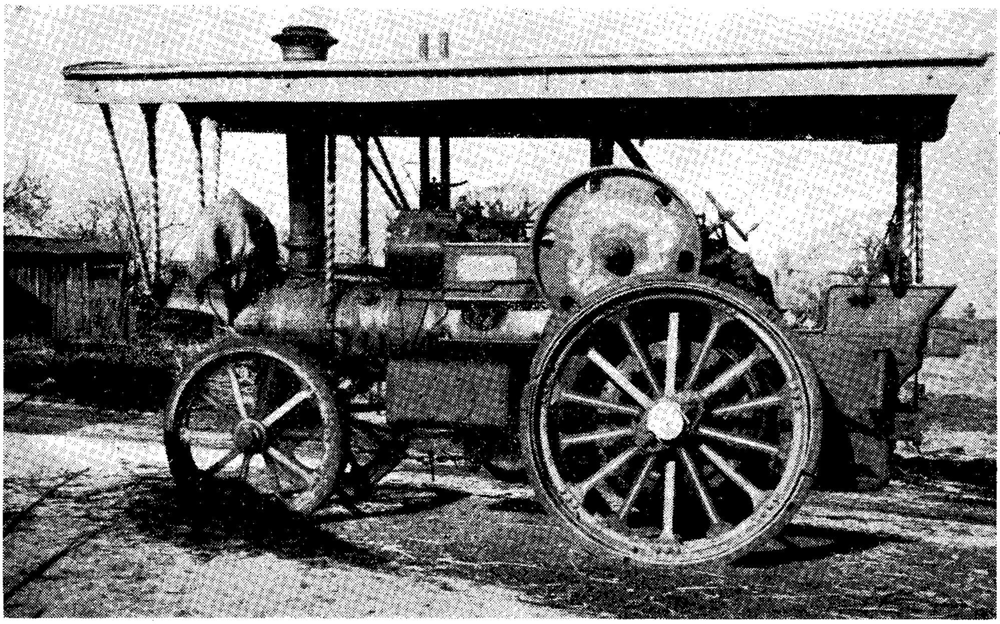
The uses this engine can be put to at present are limited by its lack of flexibility of power output and inability to reverse. The obvious use to put this machine is to drive alternators to generate electricity. The machine could be adapted for propelling locomotives and ships, if an electric transmission is used. This would make control easier and allow reversal, but of course the total weight and cost would be increased. At the present time the engine has not reached the stage of development when it can be made acceptable to industry ; but already an experimental plant has been claimed to achieve a thermal efficiency of over 30 per cent.

HUNTING TRACTION ENGINES

by W. Boddy

THE steam traction engine, that ever-popular subject of the model maker's craft, is rapidly becoming extinct. Or so I thought until I decided to obtain a few photographs of such engines before it was too late.

An aged Austin Seven on its basic petrol ration and a recently overhauled 620 Kodak Junior de luxe camera, loaded with a precious film, and our hunt was a practical proposition.



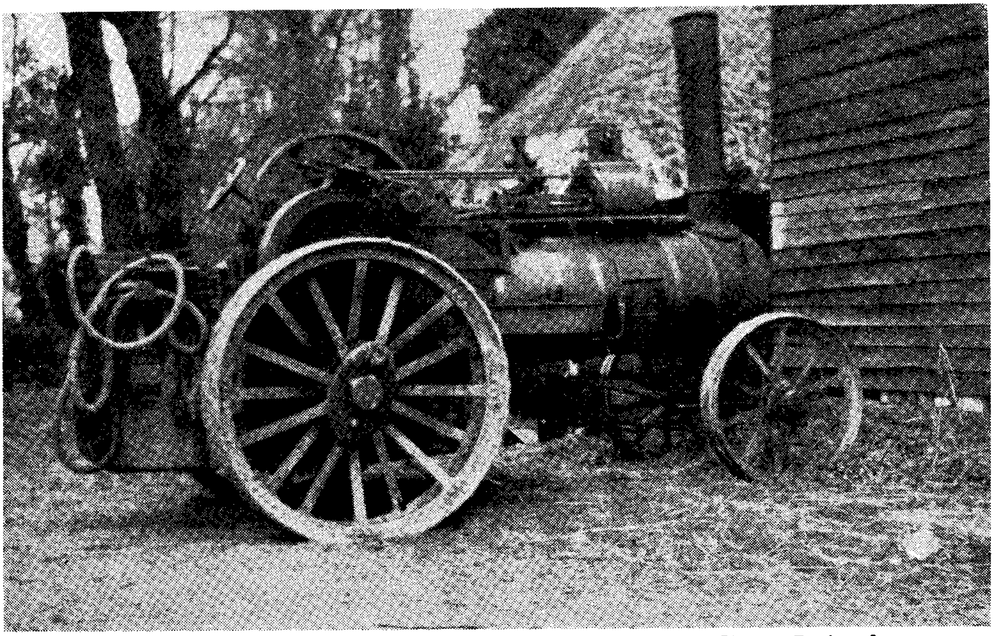
Garrett engine, "Victoria," abandoned at Eversley Cross, Summer, 1946

Indeed, what started the desire to record in some way any traction engines still more or less intact was the chance discovery, one sunny Saturday morning last winter, of one actually at work. It turned out to be a Ransomes, Sims & Jefferies (No. 27627) engaged as a stationary engine driving a saw in a timber yard. For some while after this no more engines came to light and then, quite by chance again, when I had the camera in the car, a large wheel was espied protruding from behind a haystack in a farmyard we had not hitherto passed. This "find" turned out to be a Garrett road locomotive with weather cover over its dynamo, its hose neatly coiled and a vast canopy over it on which were advertised "Up to date galloping horses." The farmer in whose yard it stood told me that it had been abandoned the previous summer by a travelling showman and left in his yard. Apparently no one has ever returned for it—are such engines really so lightly discarded or is the owner trying to recall where it was left?

Not so very long afterwards or so very far away, I came upon two more engines at a farm, this time the property of the farmer. He had many good words for one of these engines, a 9-ton Wallace & Steevens which he had recently overhauled and which he used regularly, burning wood when coal was not available. "As long as I have any land, I shall keep an engine in steam," he said. His other engine was a 7½-ton McLaren (No. 398), with water-tube boiler. Its tyres had unworn slats, and although the big flywheel could not be pulled over, I was assured that some engine oil in the cylinder would soon put that to rights. Reverting to the Wallace & Steevens, its number was 7665, and it was made in Basingstoke, not far away from where I found it; it had once been used by the Hampshire County Council—I suspect at a time when nothing "petrol" could cope with really heavy work—and bore their No. 712.

The next discovery was quite something. In a gateway beside a country road I came upon a 7-ton Fowler, built, as a plate on it proudly proclaimed, by John Fowler's Steam Plough Works in Leeds. To my surprise I saw that it had a 1947 Road Fund licence, issued to a firm, in Shinfield, Berkshire.

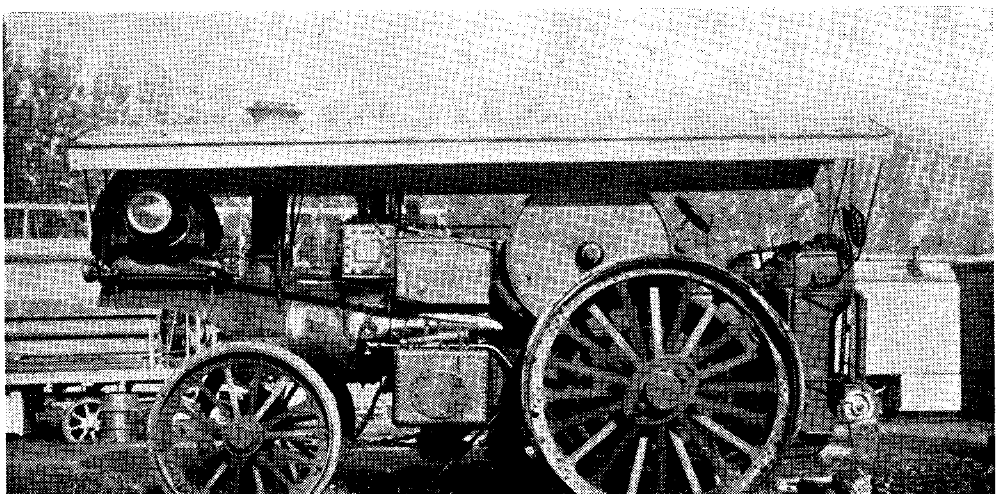
This story must conclude with one other "capture," a rather sorry Wellington Tractor (built by Wm. Foster & Co.), from which the pump had been removed. This engine was within



A 9-ton Wallis and Steevens engine, No. 7665, in use on a farm at Hurst, Berks, May, 1947

couple of miles of my home and I had been told of it by a friend, my queer taste in snapshot subjects having got around.

Considering that this hunt has been in progress for only a few weeks, I think it proves that the old steam traction engine is not so obsolete as I had supposed. Even if not so very many are working, quite a number still exist in a reasonable state of preservation, so that if you intend to model one you should be able to get your data from a prototype without too much of a search. Although the showman nowadays finds that petrol and diesel vehicles serve him well, he has not altogether foresaken steam, as I noticed when I encountered a fair at Richmond, Surrey recently.

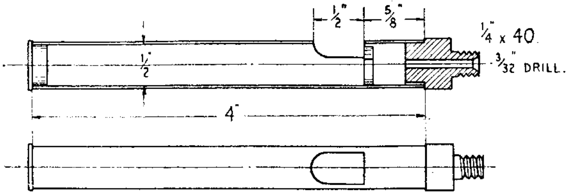


Burrell showman's engine, No. 3642, "General French," photographed by Mr. J. N. Maskelyne at Maidenhead, September 7th, 1946

"L.B.S.C."

A WHISTLE FOR "HIELAN' LASSIE"

OUR "Lassie" won't be able to say "*Hoots, mon—awa' wi' ye!*" if we don't provide the wherewithal for the hooting, so here is a sketch of a suitable whistle. It is of the simple "organ-pipe" pattern, and I have made one in less than twenty minutes, so beginners needn't be afraid of *that* job! The body is a length of $\frac{1}{2}$-in. brass treblet tube squared off in the lathe at both ends, the finished length being 4 in., but you needn't bother about "mike measurements." If treblet tube is not available, use ordinary brass or copper tube, which must be thin-walled for best results. At $\frac{5}{8}$ in. from one end, file a gap $\frac{1}{2}$ in. long to the shape shown; *not* an angular opening, or it will screech instead of warble. A friend who knows a jolly lot more than I do about music, says the slot should be rectangular for the purest note, and I tried one made thus, but I'm blessed if I could detect any difference; maybe I haven't the requisite "ear," though I love music and always did, as mentioned in my reminiscences of childhood days, about the girl who played the piano whilst I was lying on the railway bank watching the trains near Tulse Hill, back in 1890. Turn up a brass plug to a tight fit in the extreme end of the tube, as shown.



Details of the whistle

To make the disc for directing the jet of steam across the gap, turn a bit of $\frac{1}{2}$-in. brass rod to a tight drive fit in the tube, then part off a $\frac{1}{8}$ in. slice. File a clearance about 1/64 in. wide, in the edge of this, the length being equal to the width of the gap, *viz.* not quite half the diameter. Press this in level with the straight edge of the gap.

Chuck the $\frac{1}{2}$-in. brass rod again and turn down about $\frac{3}{16}$ in. length to a tight press fit in the tube; part off at $\frac{3}{4}$ in. from the end. Reverse in chuck, centre deeply, and drill right through with 3/32-in. drill. Turn down $\frac{5}{16}$ in. length to $\frac{1}{4}$ in. diameter and screw $\frac{1}{4}$ in. length of it $\frac{1}{4}$ in. by 40. Squeeze it into the open end of the tube and the whistle is complete. If the steam disc is at all slack, put a spot of Baker's fluid or other liquid soldering flux at the back of it, plus a small bead of solder and hold it over a gas or spirit burner until the solder melts and seals the disc in place. Don't have too big a bead of solder, or you'll stuff up the steam slot, and spoil "Lassie's" singing qualities altogether.

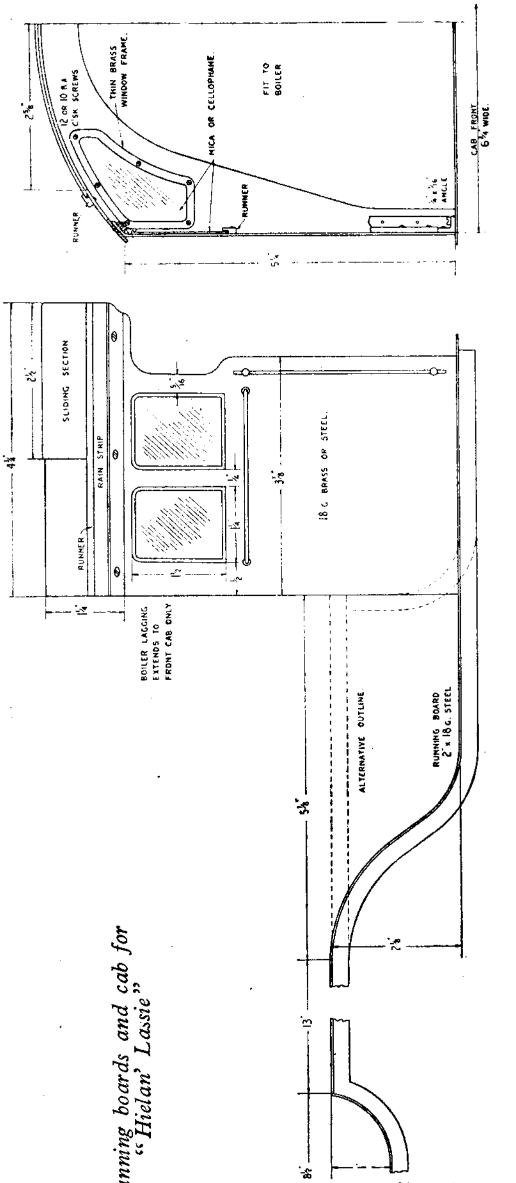
These whistles give their clearest notes when hot; so put the whistle under the ashpan, just ahead of the trailing axle and secure it with a couple of clips, made from $\frac{1}{4}$ in. thin brass strip, and secured by small brass screws (any size, within reason, that you have handy) either tapped into the ashpan, or put through clearing holes and nutted. Please note (what a lot of notes!) for best results, fix the whistle with the gap underneath and the tube sloping a little from front to back, so that any accumulation of moisture, condensed steam and suchlike, doesn't remain in the whistle tube, but drains out of the opening where the noise comes from. The whistle on my "Tugboat Annie" is fitted thus, and she reminds me of another of my old munitiongirls,towit:

There was a young lady named Joyce
She had a most beautiful voice;
In a search near and far
For an opera star
She'd have certainly been the first choice.

But whereas Joyce had many notes—she and another girl, Hazel Brown, had the sweetest-blending "harmonising" voices I ever heard—poor "Annie" only has one note, but she makes the best of it! Incidentally, if you would like a chime whistle, such as used on what the kiddies call the "screamliners," you needn't even bother to make it. Just rake out that old whistle that you or your elder relation used when doing an A.R.P. warden's job, and cut off the mouthpiece. In its place fit a union screw as described above and fix the whistle under the ashpan in the same manner. It will kick up a bigger shindy than ever it did in the A.R.P., the "Lassie's" boiler raising a little more pressure than any person's lungs! Connect the union on the whistle with the one on the turret, by a $\frac{1}{8}$-in. pipe furnished with a union nut and cone on each end. The length of pipe is best obtained from the actual job; run the pipe as close to the backhead as possible, so that it keeps hot, minimises condensation, and ensures a loud clear note.

Grate Retaining Pin

On my own wide-firebox engines, I found the following simple dodge about the easiest to work, for keeping up the centre part of the grate when the engine is in steam. Drill a No. 30 hole in the centre of the bottom of the backhead, so that it goes clean through the foundation ring below the water space. In this, fit a $\frac{1}{8}$-in. pin with a knob on the outer end, and a bit of flat steel rod as used for firebars, on the inner end; that is the lot. When the knob is pushed in, the bit of steel goes under the ends of the firebars and holds the movable part of the grate in the horizontal position. When the knob is pulled out, the bit of steel comes clear of the bars,



Running boards and cab for "Hielan' Lassie"

allowing the hinged part of the grate to drop down in the ashpan. Any clinkers or other residue remaining in the firebox can then be easily raked through the opening with a pricker, which is a bit of ⅛-in. wire with a ring at one end to hold it by, and the other with about ¾ in. bent at right angles and flattened. You'll see their big relations, about 8 ft. long or more, on any full-sized engine. This gadget will also come in handy to hold up the bars again whilst the pin is pushed in.

Running Boards or Side Platforms

The original outline drawing of the "Lassie," showed a running board above the coupled wheels going straight back to a rather short-sided cab, the bottom of which was well above the level of the top of the drag beam. This was the arrangement on the full-sized "Great Northern," after being rebuilt to Mr. Edward Thompson's ideas. However, that particular style didn't last long; the full-sized engine soon had the bottom of the cab sides lowered to drag-beam level and the running boards were also modified to suit. This improved the appearance very much and so I am specifying a similar layout for the "Lassie." The cab sides are at drag-beam level; and you can either take the running-boards down from over the coupled wheels in a sweep, just behind the third wheel, to the same level, or carry on straight to the cab, dropping to drag-beam level at that point, in a manner somewhat similar to G.W.R. practice. The lower edges of the cab side sheets can be rounded off to suit, as shown by dotted lines; just please yourselves. There isn't much in it either way, as far as work is concerned.

The running boards are made from 2 in. by 18-gauge brass or steel. It isn't any good my giving a plan drawing of them, because they have to be fitted to the actual job; and you can see much easier, on the engine itself, where to cut out the pieces to clear the firebox and so on, than from any drawing. They can be made, each in one long length, with the various bends and curves at the correct locations; or in sections, just as you prefer. For beginners I should recommend sections, the first extending from the leading end to the curve just over the combination lever; the second, a straight run from there to the cab (if the "high level" is continued to the cab) and the third under the cab itself. If the curve behind the coupled wheels is desired, the second section could run from over the top of the combination lever right to the end of the drag-beam. The distance between points and the various heights, are shown in the illustration.

On my own engines I make the valances or edging for the running boards, from brass angle riveted to the running boards. If the curves are easy, as on the "Lassie," I don't have any difficulty in making the bends; the angle is just softened by heating to red and plunging into cold water, and a bending template is used, this being merely a bit of square bar (any metal) bent to the required curve. If the curves are sharp, I don't use angle, but cut the curve out of a bit of 16-gauge sheet, which eliminates all bending difficulties at one fell swoop. Some of my 2½-in. gauge engines have a combination of

the two methods ; angle on the straight and sheet on the curves. The "Driver" jig-saw is a wonderful help in cutting curves ! Beginners and other inexperienced sheet-metal workers could compromise in the same way on the "Lassie," cutting out the curved part of the valances, e.g. from buffer beam to smokebox, cylinders to top of frame, and curves at the trailing end, from sheet, using angle on the straight. The sheet part of the valances could be soldered to the underside of the running board, with reinforcing angles at each end and one or two between ; these being merely $\frac{1}{4}$ in. lengths of $\frac{1}{4}$ in. by $\frac{1}{16}$ in. angle "dropped into the corners" in a manner of speaking, and riveted to both running board and valance.

If the running board is made up in sections, it would be best to assemble these into one unit, by riveting and soldering butt strips under each joint ; then, after the valance is attached, the whole bag of tricks can be attached to the chassis by a few screws, and it is easily detachable any time, for repairs, overhaul, or other routine work on the engine, or for putting to rights any damage caused by collision or derailment. Accidents are not quite unknown on small railways ! Two $\frac{1}{8}$ in. countersunk screws tapped into the top of the buffer beam will be quite sufficient for the front end. Cylinders and motion bracket afford support "amidships," as our nautical friends would remark ; and additional brackets can be attached below the smokebox saddle, between the rear coupled wheels, and at the trailing end. I always use "fabricated" brackets, bent up from sheet, as shown in the detail sketch ; they are neater and stronger than any cast bracket and can be made to any size, literally at a minute's notice. They can be riveted to the running board, and screwed to the frames, or screwed to both as desired. A single screw in each is ample.

The gap between frames, extending from buffer beam to saddle, is closed by a piece of 18-gauge metal cut to a fairly good fit between the frames, and bent to the same curve as the top edges of frames. It should not be fixed in any way, as it must be removable for filling the lubricator. If two small pins, say bits of 3/32-in. wire, are fixed in the front, about $\frac{3}{8}$ in. from the edge, and fit into two corresponding holes drilled with No. 40 drill in the top of the buffer beam, the piece of metal will "stay put" when running, as the pins prevent it from sliding forward, and the back end rests against the front of the smokebox saddle, which prevents it from dropping down. "Jeanie Deans" has this arrangement, and it pans out O.K. As to the footplate, this is simply a piece of 18-gauge metal extending from side to side of the cab, with the necessary clearances cut for the pipes, etc., and the location of these can best be obtained from the actual job. It need not be fitted until the cab is erected. This plate also is not fixed, but rests on the sides of the cradle or trailing frame. Our advertisers may, perhaps, be able to supply a cast chequered footplate, same as I have on "Jeanie," and it certainly "looks the berries," though Inspector Meticulous will say she should have a wooden footboard to cover the iron plate. It's up to the builder to please himself on these details !

Cab

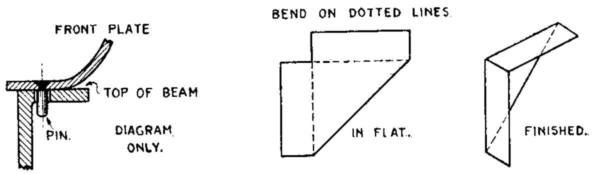
An illustration of the cab front was given along with the view of the backhead fittings and another "half-sheet" is shown here. Cut it from 18-gauge brass or steel and fit to the firebox wrapper. Note that the lagging on the boiler should extend only to the cab front and not come inside it. The radius of the roof is $5\frac{1}{4}$ in. It is difficult to dimension correctly the size of the front cab windows, because of their awkward shape ; but if you make them $1\frac{11}{16}$ in. from extreme "north to south" and $1\frac{3}{8}$ in. extreme "east to west," they will be about "scale" size. The shape is shown in the illustration. Pieces of thin sheet brass are cut out to form window frames as shown, and either riveted to the cab front on the inside, with bits of domestic pins, or attached by 12-B.A. screws, a piece of thin mica or cellophane being sandwiched in between frame and opening in cab, to act as a glass window. I hate to see gaping holes where there should be windows, they remind me of the eye sockets in a skeleton's skull ; yet even on so-called high-class commercial jobs, the window openings are innocent of any "glazing."

When cutting out the cab sides to the given dimensions, allow $\frac{3}{8}$ in. extra at the top and bend it inwards, as shown in the half-front view, to form an attachment for the cab roof. The window openings are edged with half-round wire (commercial article) soldered on, and the mica or cellophane windows are made instantly removable by the simple expedient of riveting a runner at top and bottom, inside the cab. This is merely a bit of 3/32-in. by $\frac{3}{16}$-in. brass strip with a rebate milled or planed in it (see section). The two windows are in one strip which covers both apertures and fits the runners.

A favourite trick of my own is to lay out the cab front and both sides on a single sheet of metal ; cut them out in one piece and then bend to shape along the lines of the corners of the cab. This saves making two corner joints and gives a neat finish. If you make them separate, join the front and sides with pieces of $\frac{1}{16}$ in. by $\frac{1}{4}$ in. angle in the corners, as shown at the bottom of the half-front sketch ; and rivet a piece of similar angle along the bottom, for attachment to the running board.

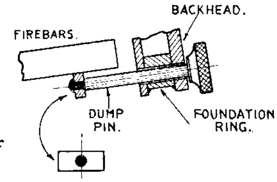
The cab roof is a piece of 18-gauge metal measuring $7\frac{3}{4}$ in. by $4\frac{3}{4}$ in., curved to the radius of the top of the cab front, and is attached to the bent-in part at the top of the cab sides by countersunk screws and nuts ; three each side will do, and the size doesn't matter within reason. Use anything in stock. For convenience in driving, make it a "sunshine roof." Cut a gap out of it measuring about $5\frac{1}{2}$ in. by $2\frac{1}{2}$ in., and at each side of this, rivet a runner, same kind as used for the side windows extending the full length of the roof, as shown in illustration. If you have no means of milling or planing a rebate in a bit of strip, you can use two strips of sheet metal, one wide and one narrow, placed together, with the wider one on top. The sliding part of the roof is simply a piece of sheet metal, a full $2\frac{1}{2}$ in. from front to back, curved to suit the roof and just wide enough to slide between the runners. When driving the engine, slide the movable part forward and you have access to

"the handles"; but here a warning! Round off the edges of the cut-away part and also the corners, or you may get a nasty gash on the back of your hand. A correspondent who omitted to do this and left two sharp-edged right-angles at the back of the cab roof instead of rounding them, had the back of his hand torn so badly, when the engine swerved just as he was reaching for the regulator, that it needed stitching.



Removable front plate, and sheet-metal brackets


Section of built-up runner



Grate retaining pin

A separate rain strip of half-round wire, may be soldered to the cab roof at each side if desired; or the runner may simulate this, if the opening in the roof is made wider. The fixed part of the roof may be attached to the cab front by a couple of short pieces of angle; or if you like to take the trouble, by a piece of angle bent to the curve of the roof and riveted to the cab front. Countersunk screws are used for attaching the roof to the angle. The hand-rails are made from nickel-bronze wire, but you needn't bother about those until you fix the others on the sides of the boiler, when the lot can be done at one go.

In passing, may I exhort all beginners to take special care over the plate work; the "Lassie" is a really worthy engine and deserves to be finished off accordingly. Maybe "handsome is, as handsome does," as the old saw puts it; but many folk, unfortunately, lose interest when the working parts of a locomotive are finished and the rest of the job has to suffer in consequence. Once she is on the road and doing the job, that is all they care about. Performance, naturally, stands first with your humble servant; I've not the slightest use for a dolled-up box of tricks of the "scale model" brand, that hasn't a halfpennyworth of kick in all its constitution and is merely a glorified toy. However, being born and raised, so to speak, in the Stroudley tradition, I know it is quite possible for an engine to "do the doings" in the manner approved, and at the same time be "a thing of beauty and a joy to behold," as the poet said of his pet girl friend. At the time of writing, I have heard from Mr. Corbett, of the Yeovil Live Steamers and Mr. Jeffries, of the Harrow S.M.E., that they have had their "Lassies" in steam; and my estimate of performance is fully borne out. They say the biggest trouble is to keep the boiler quiet! This is a good "distant signal" as to what all the rest of the "Lassies" will do when they take the road; so it is up to their builders to make their appearance as good as their performance.

The next job is to provide a suitable tender, and then a few "knick-knacks" will finish her off.

Models Presented to the G.W.R.

There has recently been placed upon "The Lawn" (the Circulating Area) at Paddington station a show-case which seems destined to become a "Mecca" for locomotive enthusiasts, for many years to come. The case is 26 ft. long and contains four splendid $1\frac{1}{2}$-in. scale, $7\frac{1}{4}$-in. gauge models representing, respectively, the G.W.R. 4-cylinder express passenger locomotive No. 6000, *King George V*, a "Cornish Riviera Express" corridor coach, the first closed railway-carriage *Experiment* and George Stephenson's *Locomotion*. In addition, there is displayed a complete set of locomotive tools in miniature, such as fire-irons, oilers, spanners, etc., carried by a "King" class engine.

These models are a personal gift from their builder, Mr. B. R. Hunt, of Johannesburg, South Africa, to the Directors of the Great Western Railway, and took twelve years to complete. Many "M.E." readers will recall that on March 3rd, 1938, we published an illustrated description of the "King" model, which was then well on the way to completion; it is probably one of the finest models of a "King" ever built. It is 8 ft. 6 in. long, over buffers, and weighs more than 1,200 lb. Every external detail, including the presentation bell and medallions carried by the prototype engine, is included; and, in view of the distance which separates Mr. Hunt from the Great Western Railway, the standard of accuracy achieved is remarkable.

The four exhibits, judged as a whole, provide a striking study in contrasts, illustrating, as they do, the great change which has taken place during 120 years of railway rolling-stock design and construction. The directors of the G.W.R. are to be congratulated, not only upon the acquisition of such a gift, but also upon their enterprise in allowing the public to share the enjoyment of it.

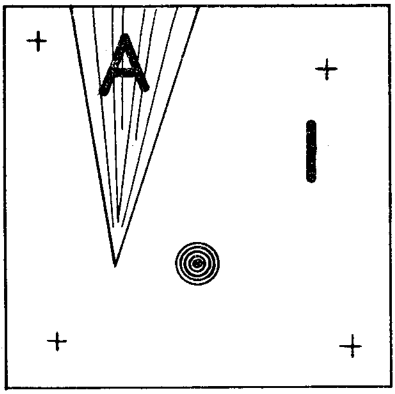
MAKE YOUR OWN CLUB BADGE

by "Finsbury"

THE forthcoming MODEL ENGINEER Exhibition has been made the occasion for a new badge for the Ilford & West Essex Model Railway Club. The club emblem is a full-sized tail-lamp of the old G.E. Railway, and the original badge featured this lamp in miniature, in the flat. The bull's-eye was half a lentil glued on before the second coat of paint. The new badge has the club initials in a scroll under the lamp, the whole being cast in type-metal. The bull's-eye is now a snap-headed rivet which secures the button-hole clip. This latter is a press-tool job, and is being made by another member. The lamp handle is the large end of a wire paper clip cast in. The initials and the edges of the scroll are raised, and after the paint is hard it is scraped off these to make them show up more distinctly.

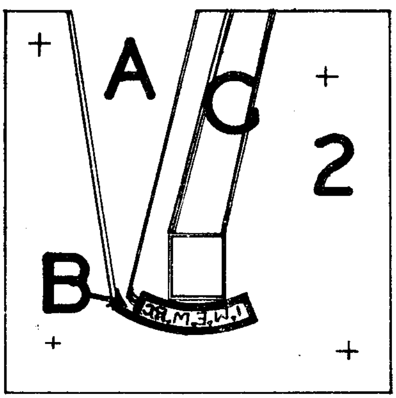
A description of the mould may be an encouragement to others to design and make their own badges. There is nothing difficult about it, The construction of this mould and the first three or four casts " off, " together with the necessary alterations to risers, etc., was completed in two evenings. The run of sixty lamps was finished in a third. Cleaning-up takes very little longer, if you are careful with the mould plates.

Any metal, in reason, may be used for these plates. But they must be flat when finished. Cut them out with a saw (not snips, unless you are good at planishing), square-up the bottom edge, one corner and the adjacent side. Mark them with figure-punches or pop-marks, in the correct sequence, and drill the holes for the dowels. These may well be 5-B.A. steel screws with a long plain part under the head. Cut off the heads, and round off the ends. Tap the holes for them in the backplate, No. 1, and screw them in tightly, cutting off any projection at the back and filing flush. Open out the holes in the other plates to a nice fit for the plain part of the dowels, which should be long enough to come just *not* flush with the outer side of the cover-plate.

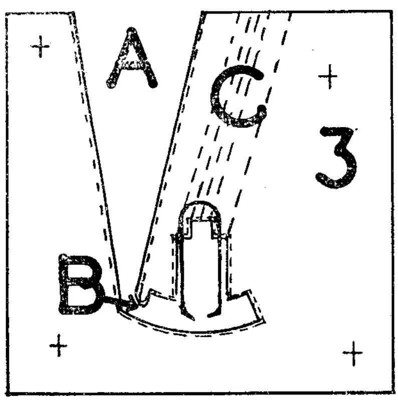


Back plate, $\frac{3}{16}$-in. thick aluminium alloy. Holes tapped 5-B.A.

Mark out the plates and cut them out with a jeweller's piercing saw, filing to the line and leaving the edges of the hole square for the time being; put the " draw " or taper on when they are all finished. If the shape is at all intricate, it is quite permissible to mark, cut and file out one plate and to use that to make the others. The grooves which, when filled with the casting metal, will form the raised edges to the scroll are best put in in the lathe. Chuck the backplate in the four-jaw, and the dowels will act as driving-dogs to take the other plate(s) round as required. An eighth of a circle will be about right for the length of the scroll, but take care to get it equally

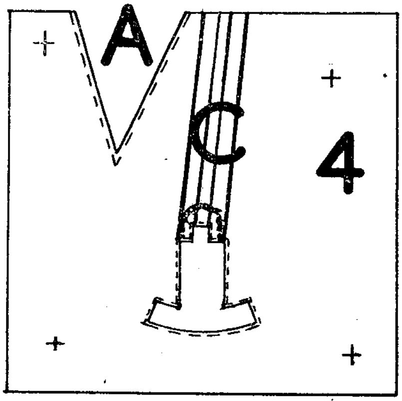


Brass, $\frac{1}{16}$-in. thick. Hole cut out for front of lamp. Grooves for raised edge of scroll cut, and letters punched in reverse. Risers on front face. Small gate. Holes drilled No. 30



Brass, $\frac{1}{16}$-in. thick. Hole for lamp body and scroll cut out in one piece with runner and gate. Risers on back face and groove for paper clip on the front face

halved on the centre-line of the badge. Put the grooves in with a screw-cutting tool with slightly more radius on its tip than usual. Rack the work back and forth by hand and widen the groove by the cross-feed, putting on the cut with the longitudinal feed. The two ends can be cut out with a similar tool on its side, winding it in with the cross-feed handle, and widening the groove by alteration of the packing, rocking the work to keep the cut truly radial to the centre of the circle.



Brass, 20-s.w.g., hole for lamp body and scroll. Risers on front face, groove for clip on back face. Small Vee to increase size of runner

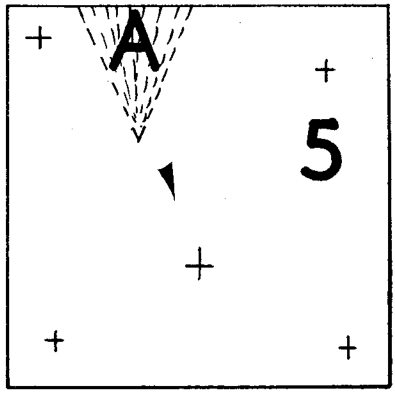
For the initials, letter-punches, $\frac{1}{16}$-in. size, from the Imperial Typewriter Co. Ltd., Leicester, were used. One special one, the "R" in reverse, was obtained promptly on request. Of the other letters, the I, M and W were used normally, the E and C being turned upside-down. The normal punch is made with the letter reversed on its end, so that it comes out the correct way round on the work. We want readable letters on the end of the punches, so that they are reversed on the work, and when the depressions are filled with casting metal the raised letter is again readable. Reversed punches in this size are readily obtained from Leicester at a small cost each.

The "dimple" in plate No. 1, for the head of the rivet, was formed with a steel ball, and metal which crept round the edge was filed off as the work proceeded by stages. Where the rivet-head is not required to show on the front of the badge a countersunk rivet can be cast into the body of the badge with its shank protruding through a well-fitting hole in the backplate. A sloppy fit on this hole will lead to loss of metal when casting.

The end of the paper-clip forming the lamp-handle is loaded into a depression caused by squeezing one of these clips into the two plates, Nos. 3 and 4, which are of brass. A crude but effective method of securing correct position of the wire whilst so doing is to stick it in position with a bit of gummed paper tape.

In this particular five-piece mould the runner and gate are cut out in plates 2 and 3, with a wedge-shaped piece removed from No. 4, and rounded depressions filed into the back and cover-plates, so that a fairly thick stick of the casting metal can be pushed down the runner when the mould is heated up for casting.

Risers are most important. It was found that a riser was essential from each top corner of the lamp, and also its chimney. Without these the corners came out rounded; with them they are as sharp as can be required. Risers are deep scriber-marks which are accentuated with a three-cornered file into V-shaped grooves. Bring them right out to the top of the plates. They are put in on the front of plates 2 and 4, and on the



Back plate, $\frac{3}{16}$-in. aluminium alloy. Four No. 30 drill holes. Centre hole fitting size for shank of rivet

back face of No. 3. In this way, "keying-in" of the casting is avoided.

When you are satisfied that the holes in the plates are as perfect as you can make them and still square with the faces of the plates, then put on the "draw" or taper, not forgetting the sides of the runner. The front face of No. 2 and the back face of No. 3 must be larger and wider than their opposite sides. Any hole in No. 4 had better be cut under size, and filed out to fit the small end of hole in No. 3 at its larger side. It will have to be tapered too, smaller at the front. The casting will then come easily out of the mould when you want to extract it.

The best metal for use in these moulds is old compositor's type-metal. This can often be bought "for a song" from small printing works. It is rich in antimony, which expands when it freezes, and thus takes much finer detail than plain lead which shrinks away from the mould as it sets. Whatever you use, melt it down in an old tin, ladle, or what you like, and pour it out on to a steel plate in a thin stick. Do not overheat; a piece of paper applied to the molten metal should char but not flame. When you have enough of these sticks you are ready to prepare the mould for casting.

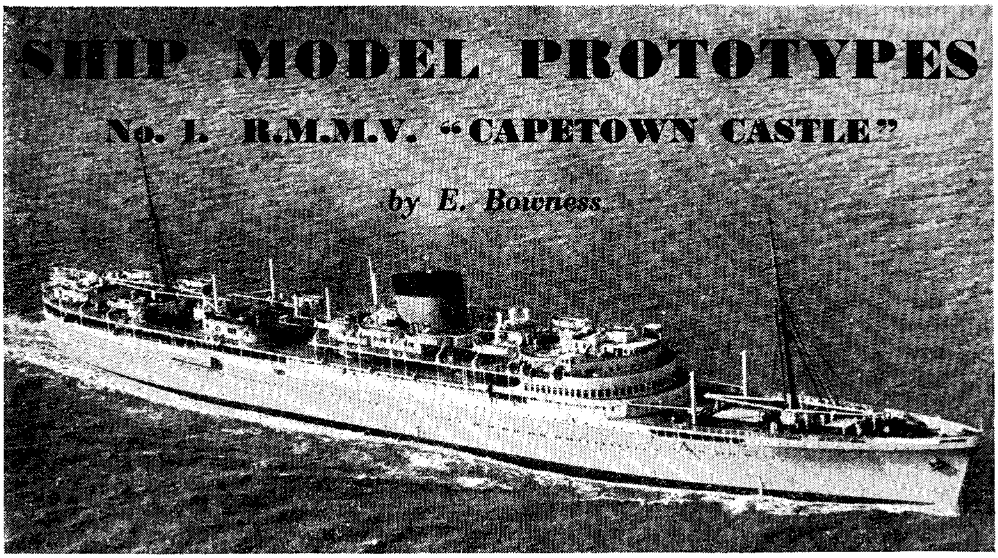
Well smoke both sides of all the plates over a candle and assemble them in correct sequence and load in any inserts which have to be cast in. Clamp by the bottom in the vice, and close up the top corners with two C-clamps. Leaving these on, remove from the vice, and heat up over a bunsen, gas-ring, or on a hot-plate until the

(*Continued on page* 124)

SHIP MODEL PROTOTYPES

No. 1. R.M.M.V. "CAPETOWN CASTLE"

by E. Bowness



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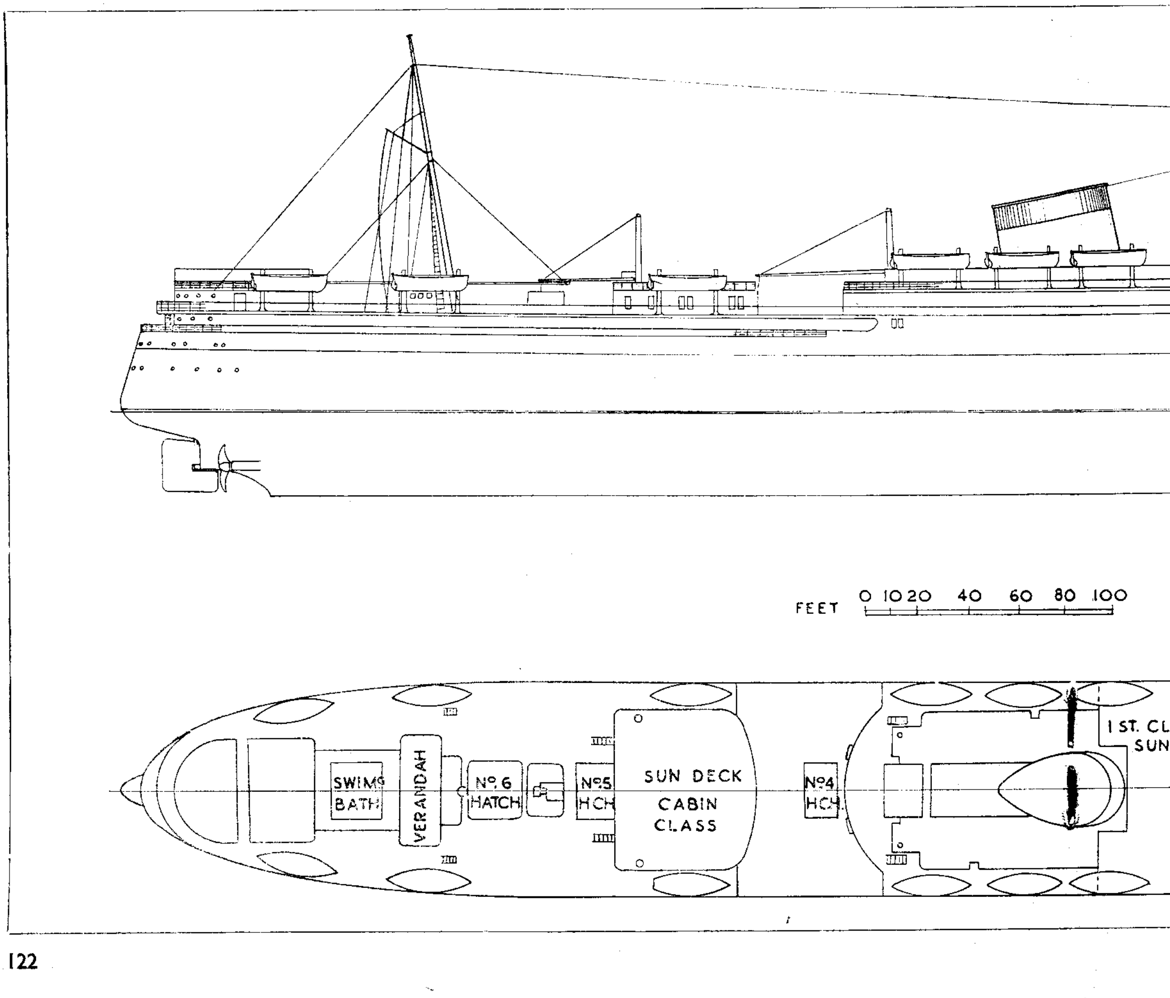


We propose from time to time to give photographs and a few leading particulars of ships of various types which we consider suitable as prototypes for ship modelling. The series will include liners, both cargo and passenger, cross channel packets, tankers, coastal ships, trawlers, tugs, steam and diesel yachts, sailing ships and historical ships, in short any type of ship which might appeal to the varied tastes of our readers.

The drawings given will be of the actual ship and nothing will be included to provide the extra displacement usually found necessary when designing a working model. This allowance of course varies with the scale of the model, a small model requiring a greater percentage of increase to its under-water body than a large one.

We commence the series with the *Capetown Castle* the latest and the largest of the famous Union Castle liners. The photographs have been very kindly lent us by the Union Castle Steamship Co. Ltd., and the drawing has been prepared from those given in *Shipbuilding and Shipping Record* for April 28th, 1938.

The *Capetown Castle* was completed in 1938 at the Belfast yard of Harland & Wolff Ltd. She has a gross tonnage of 27,000 tons and is built to the following dimensions :

Overall length, 734 ft. 3 in., (approximate.)

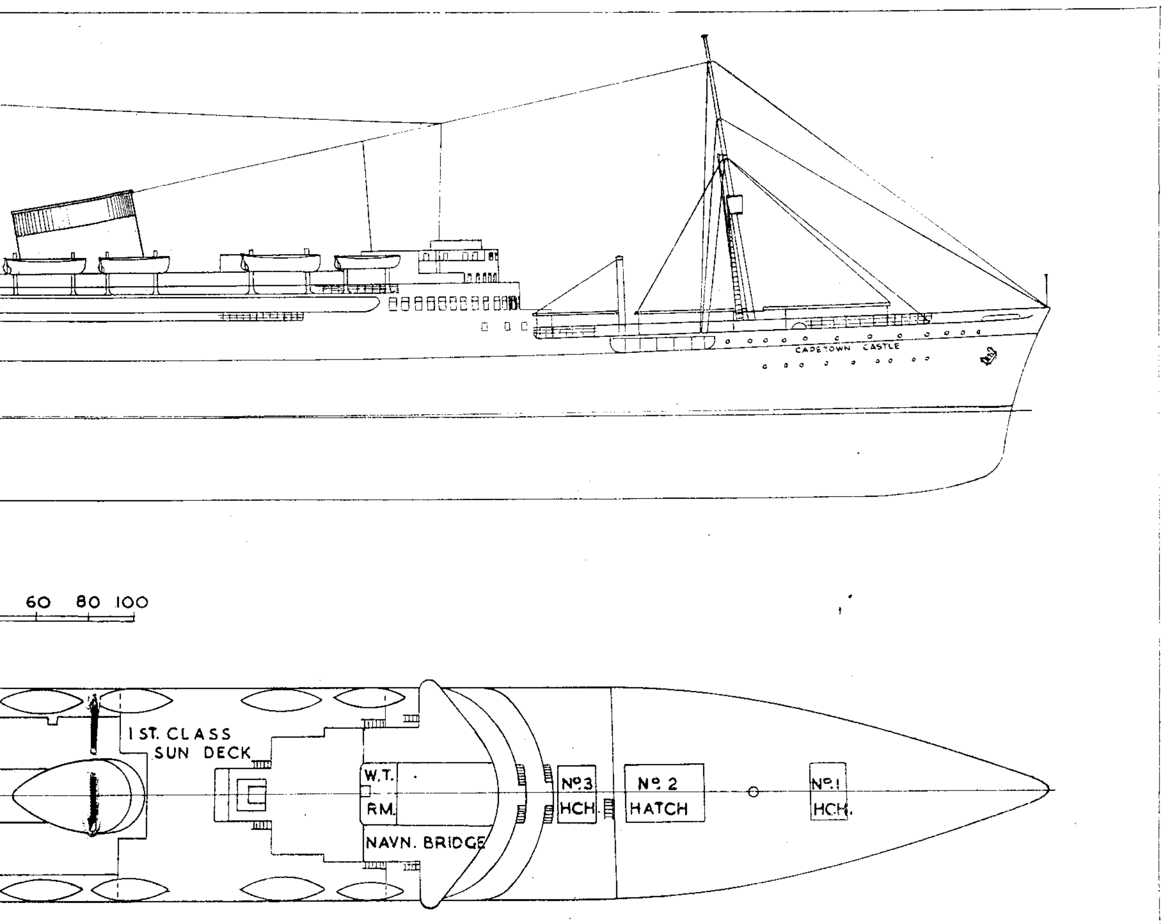
Length between perpendiculars, 685 ft. 5 in.

Moulded breadth, 82 ft.

The twin main engines, which are direct coupled to their respective screws, are of the Harland B. & W. 10-cylinder double-acting, two-stroke type, with a bore of 660 mm. and stroke of 1,500 mm. Accommodation is provided for 292 first-class and 499 cabin-class passengers.

The *Capetown Castle* was put into the Southampton to South Africa service in May, 1938, but was, of course, requisitioned by the Government on the outbreak of the war. After a strenuous spell of war service, through which she came practically unscathed, she is now back again on her usual run.

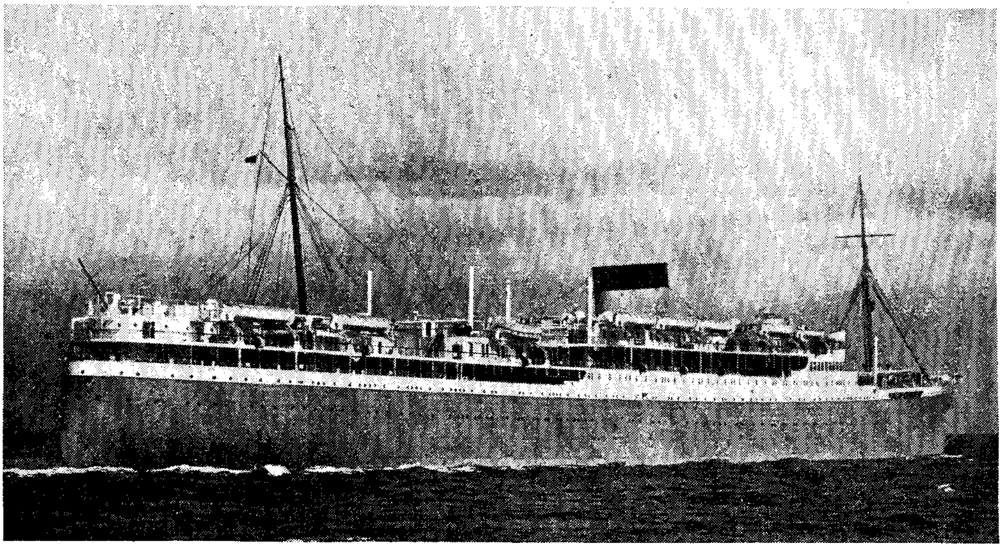
The photograph taken on the starboard quarter emphasises the graceful lines of the ship, the shapely cruiser stern and the fine flare of the bows. The photograph taken from the air, which is



actually of her sister ship *Stirling Castle*, gives a very vivid impression of the appearance which a scale model would have in action. The modern raked stem, the rounded front of the bridge and superstructure, and the squat streamlined funnel are clearly shown. We are unfortunately unable to show the vessel in colour, but all ship lovers are familiar with the very smart colour scheme of the Union Castle liners, and can imagine how effective a correctly painted model would be.

From the outline drawing and the scale which is included, the prospective model maker will be able to form some idea of the size of the model to suit the scale he has in mind. An exhibition or glass case model need not be very big as its position in the home has to be considered, but the working model should be made as big as the builder can handle. The larger size reduces the problems of displacement and stability and gives one a hull capable of carrying the many accessories and refinements which are required, more particularly if the model is steam driven.

For a steam driven model most builders prefer a smaller ship as prototype as, owing to the larger scale, the fittings are more robust and are better able to withstand the amount of handling which a working model receives; but because of its handsome appearance on the water, the liner is always a popular model. To a man who has the patience to do a lot of repetition work, the innumerable details are no deterrent. The most suitable power unit is the electric motor, as there is then no danger of damage to the structure from the boiler or blowlamp. Also an electric motor or a pair of them, gives a reasonable scale speed and the quiet steady motion usually associated with a liner.



The Union-Castle R.M.M.V. "Capetown Castle" (27,000 *tons*)

Make Your Own Club Badge

(*Continued from page* 121)

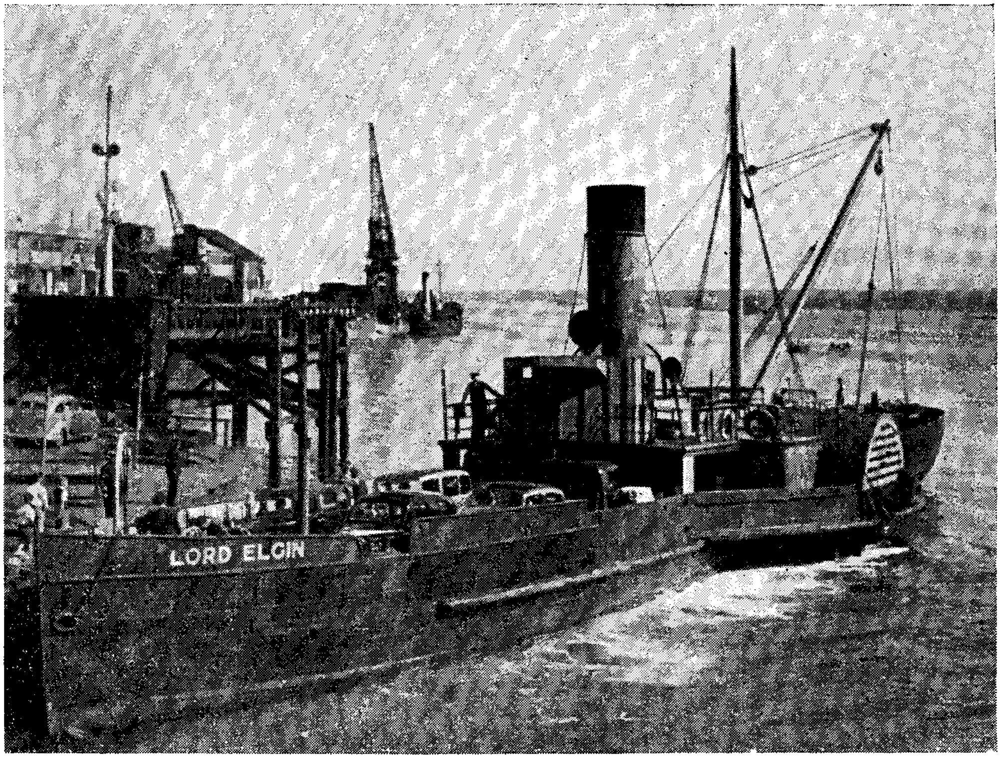
part of the mould most remote from the source of heat will melt the thicker end of one of the strips of casting metal. Remove from the heat and without losing any time clamp up in the vice and *push* the thin end of the metal stick into the runner, *forcing* it in as it melts until the risers all fountain small spurts of metal, and the "V" of the runner is full. Allow to cool naturally; make sure that the metal is completely set. Remove the clamps and cool off in water. Be cautious here. *Never* attempt to apply water if there is the least doubt that the metal has set, inside as well as outside the mould. The rapid generation of steam will expel *violently* any metal that has not set, probably into your eyes. When cold enough to handle, prise-off the cover-plate, and the others in turn, when the casting will be removable when you come to it. Break off the runner at the gate, which should be made small in section so that it will come easily away from the casting. All overflow of metal can be re-melted from time to time as required.

The sketches show the plates as viewed from the cover-plate side. A is the runner, B the gate, C, C, the risers, shown dotted where they are on the back of the plate. Make the plates large in relation to the size of the casting required, as this gives static head of metal as well as the pressure head obtained by pushing in the melting strip of metal.

Any queries will be answered willingly, either through the Editor, or at the Club stand at the MODEL ENGINEER Exhibition, where the badges may be on view to those interested.

A GRAND OLD LADY OF THE SEA

by G. E. C. Webb



THIS Mid-Victorian lady with the very masculine name is still capable of earning her own keep. Although she is over seventy years old, rain or shine she still does her daily trip with cargoes from Southampton to Cowes, Isle of Wight, and back. She is a Jack—or should it be Jill!—of all trades, and carries anything from cattle to packets of gramophone needles or perhaps even supplies for model engineers in the Island; anything and everything to the tune of fifty tons. She is also used on occasion to carry motor cars between the Island and the mainland and our picture shows her engaged on this service arriving at the pier pontoon at Southampton. The cars are driven on and off the steamer under their own power by their owners, and to enable this to be done *Lord Elgin* is equipped with double doors on each side. Those on her port side can be clearly seen in the picture, just forward of the bridge. Note the very substantial single mast on the afterdeck, complete with derrick.

The ship was built of iron in 1876 by Richardson, Duck & Co. at Stockton-on-Tees for The Swanage & Poole Steam Packet Co. Ltd., of Poole. Her dimensions are 160 ft. between perpendiculars, 20 ft. beam and 6.8 ft. moulded depth, and her tonnage is 117 net. She is, or was, powered by a 2-cylinder diagonal compound engine of 75 h.p. with cylinders 22 in. and 42 in. bore × 42 in. stroke. We have no information as to whether or not the present engine is the one fitted originally.

She belongs to The Southampton, Isle of Wight and South of England Royal Mail Steam Packet Co. Ltd., the longest name in the register, "Red Funnel Steamers" for short.

Busy Burton

We are pleased to hear that the Burton-on-Trent Society is developing on good lines, particularly in regard to making friendly contact with other clubs. Swadlincote have been over to see a display of Burton's "bits and pieces." An interesting evening was spent at the Burton Power Station through the courtesy of the Borough Electrical Engineer, and another visit to the works of Messrs. Orton and Spooner revealed the constructional side of showman's engineering, an unusual but very attractive subject for the model engineer. Prospective members should get into touch with Mr. J. F. Brown, 9, Needwood Street, Burton-on-Trent.

A NEW TYPE OF
MINIATURE ELECTRIC MOTOR

THE application of mechanical power to all sorts of uses has been increasing at a very rapid rate for many years and shows every sign of still further expansion. In many fields, there is no more convenient source of power than the electric motor, and in consequence the demand for motors of every conceivable type and size has exceeded all bounds, and has heavily taxed the resources of manufacturers to keep pace with it.

While the design of small fractional horse-power mains motors had advanced steadily, in keeping with the times, the position of the small, low-voltage motor has not been anything like so favourable and except in a few limited instances, design has remained almost stationary for many years. Perhaps the tendency to regard such motors as mere toys has been partly responsible for this state of affairs, but in any case, it is a fact that the application of electric power to small portable appliances has often been restricted by the lack of a really efficient motor of suitable size and voltage.

It is, therefore, of particular interest to note that a new type of electric motor has now been introduced and put into large quantity production, in a range of sizes from the near-miscroscopic upwards, and running on voltages from $1\frac{1}{2}$ to 24. The working principles of these motors are particularly ingenious and result not only in a higher efficiency than has hitherto been attained in the orthodox type of motor, but also in a simplified form of construction which is conducive to improved reliability and durability.

The new type of motor, which is known as the "Electrotor," consists of the following essential parts, as illustrated in Figs. 1, 2 and 3: (1) A permanent ring magnet which forms the main carcase of the machine and also the field magnet; (2) an armature composed of an iron wire core of annular form, with a toroidal winding of fine insulated copper wire, mounted on a bobbin (3) and spindle (4), and two end plates (5) incorporating bearings for the spindle, and to which are attached spring contact brushes (6); a flexible insulating covering (7) is wound around the magnet, and serves, in conjunction with the metal clips (8), as a means of holding the assembly together, and insulating the extensions of the brushes (6), which form the main terminal connections.

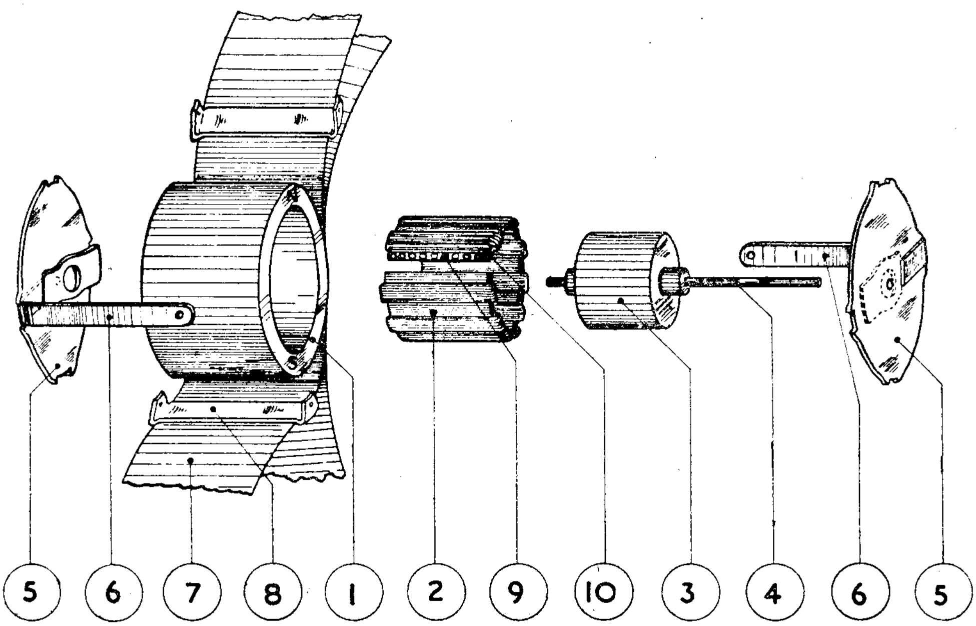


Fig. 1. The internal components of the "Electrotor"

It will be seen that the iron armature core has a gap in it at the point (9); this plays an important part in the working principle of the motor. The core (10) is composed of high permeability iron and is cemented into a solid mass by a coating of insulating material. It is wound with double nylon-coated wire in several layers, the edges of the windings where they pass from the outside to the inside of the core being bared, so that they form virtually commutator segments,

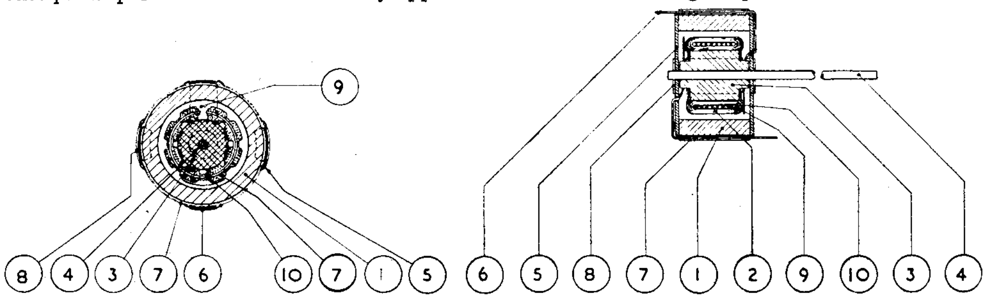
with which the brushes make contact as the armature rotates, so as to energise all the layers of the windings.

Principle of Operation

The magnet is magnetised so as to produce consequent poles at two diametrically-opposed points of the rim, being thus equivalent to the orthodox two-pole field magnet, with poles spanning the diameter of the armature. When no current is flowing in the armature, magnetism is induced in the iron core, producing poles of opposite polarity to the adjacent magnet poles. Assuming that the gap in the core is opposite to the S pole of the magnet, both ends of the core will have induced N polarity and the centre of its periphery will become a consequent pole of S polarity, as shown in *A*, Fig. 4.

Application of current to the armature windings, however, causes the conditions of magnetism in the core to change and it becomes a magnet polarised between the points at which the brushes make contact with the windings and the core ends. Thus the end nearest the positive brush becomes a N pole, and that nearest the negative brush, a S pole, with the previously induced magnetism (from the ring magnet) superimposed so that the N pole is strengthened and the S pole weakened, as shown at *B*, Fig. 4. The result is that the N pole is attracted to the S pole of the magnet, and the S pole repelled, producing a torque effect in a clockwise direction, the strength of which is determined by several factors, including the flux of the permanent magnet, the applied E.M.F. and the width of the air gap in the core.

Continued rotation of the core to the position *C*, causes the magnetism at the N pole of the winding to become more evenly distributed, and that at the S pole to become correspondingly more concentrated, so that the torque effect continues, until eventually the position *D* is reached, where both ends of the iron core opposite the negative contact brush and magnetism is equalised in the two halves of the winding. This produces strong S poles at the ends of the core and a strong N pole in the centre of its periphery, with resultant torque, still in a clockwise direction.



Figs. 2 and 3. Transverse and axial sections of the "Electrotor"

Further rotation of the armature causes the current flow conditions to be reversed as compared to the conditions at *A* ; the N pole of the armature is concentrated under the positive brush, but the polarity is then opposed by the induced magnetism, while that at the negative brush is augmented, as shown at *E*. It will be seen, therefore, that throughout the cycle, the torque effect is substantially in one direction, though varying in intensity at different points in the cycle, and there are no neutral points. The motor is therefore a certain self-starter, and in common with orthodox permanent magnet motors, is reversible simply by changing the polarity of the main connections.

"Electrotors" are manufactured in four sizes, the smallest of which, type 001, has a diameter and a length of only 5 mm. over the body and weighs only 1 gramme. It attains a speed of 7,000 r.p.m. on $1\frac{1}{2}$ volts. The type 240 has a diameter of 22 mm. and a length of 14 mm., weighing 21 grammes, or approximately $\frac{3}{4}$ oz. Next size, type 320, is 30 mm. diameter by 19 mm. long, weight 84 grammes, and the largest, type 440, is 38 mm. diameter by 35 mm. long, weight 161 grammes.

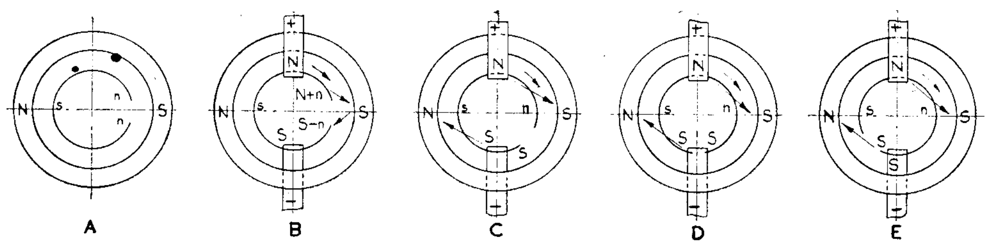


Fig. 4. Diagrams illustrating working principles

It is perhaps unnecessary to attempt to make any detailed catalogue of the uses to which these motors can be applied, as readers will have no difficulty in forming their own conclusions, but

(*Continued on page* 130)

Competitors lining up for the nomination race

THE BLACKHEATH REGATTA

SUNDAY, June 22nd, was the date of the annual regatta of the Blackheath M.P.B.C., and turned out to be a repeat of last year's successful event, both in the fine display of boats and the good weather.

An amusing incident occurred just before the commencement of the day's sport. One of the Orpington members produced a "mystery" boat, carefully shrouded in wrappings. When revealed, it turned out to be a model rowing boat, complete with occupant, who actually rowed the boat along Electrically driven, this effort caused a great deal of hilarity.

The first event was the nomination race, which produced 17 entries. Several of the boats running were making their first regatta appearance, notably Mr. Vanner's tug "Ida," Mr. Rayman's steam launch "Yvonne," and the winner of the event, Mr. Griffith's prototype "Orangeleaf," besides several others.

The course was a measured 50 yds. and as two runs were allowed, the "guessing" was particularly accurate, the officials having a hard job to sort out the successful competitors. Very good runs were put up by Messrs. Jepson (Blackheath), Squires (Malden), Curtis (Victoria) and several others.

Mr. Griffiths (Blackheath), with "Orangeleaf," a carefully-made prototype boat, which is electrically driven, won first place, with only 0.3 sec. error.

The result of the nomination race was:

1st Mr. Griffiths (Blackheath), "Orangeleaf," error 0.3 sec.

2nd Mr. Vanner (Victoria), "Leda III," error 0.4 sec.

The next event was a 300 yd. circular course race for B and C class racing boats, the entries for which included several interesting boats. Especial mention should be made of Mr. Curwen's "Elf," fitted with the 5 c.c. petrol engine converted to compression - ignition, recently described in THE MODEL ENGINEER.

Mr. Heath (Victoria), having repaired the original hull of "Derive," had two fairly successful runs, but not at the full speed that "Derive" has shown in the past.

Mr. Jutton (Guildford), with his flash steamer "Vesta," seems to be right out of luck lately. Not content with hitting the bank at Victoria Park in the International, "Vesta" once again misbehaved. Getting away on a slightly slack line, "Vesta" snatched badly and capsized, cutting the line in the process.

The other flash steamers fared somewhat better, Mr. Benson (Blackheath), with "Erg," after one false start, put in a clean run at 22 m.p.h., and Mr. Martin (Southampton), with

"Tornado IV" on his second attempt, made a magnificent run, at a speed of 35 m.p.h. Mr. Martin's smaller flash boat "Tornado III," did not perform quite so well as in the International, but put in two clean runs.

Mr. Curwen (Victoria), with "Elf," now compression-ignition operated, could not hold the line tight on his first run, but after fitting a smaller propeller, made a very creditable showing.

The results of this event were as follows:

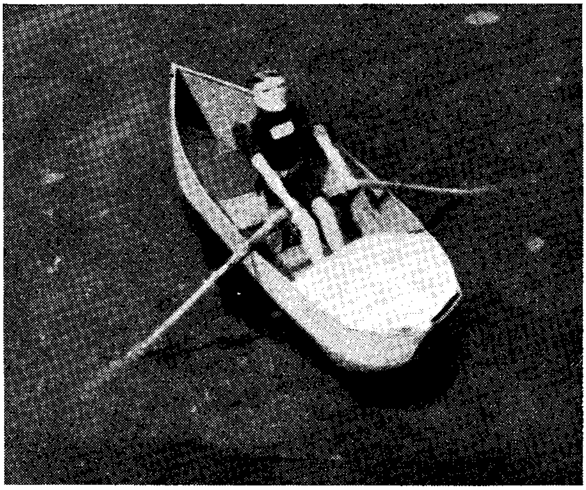
1st, Mr. A. Martin (Southampton) "Tornado IV," 17.5 sec., 35 m.p.h.

2nd, Mr. Curwen (Victoria) "Elf," 26.6 sec., 23.1 m.p.h.

Special prize for C class boats, Mr. Curwen, "Elf."

After a short break for lunch, the free-running boats made a further appearance for the steering competition.

Since the steering competition is run over the same course as the nomination race, it was expected to see some good "target shooting," but the reverse was the case, as a breeze had sprung up, and was blowing across the course. The same boats that had taken part in the nomination event were running in this, and of these, only eight craft returned a score of any kind.



Hello! Here's a new class of racing models "sculling round" in the offing!

Mr. Squires (Malden), with "Comet III" scored an outer, then a bull, but missed the target on his third run, this effort was duplicated by Mr. W. Whiting (Orpington), with "Rose Marie," and these two had to re-run for second place.

Mr. Vanner (Victoria), demonstrated that "Leda III" could still put up a good show, by scoring a total of five points, which made him the winner.

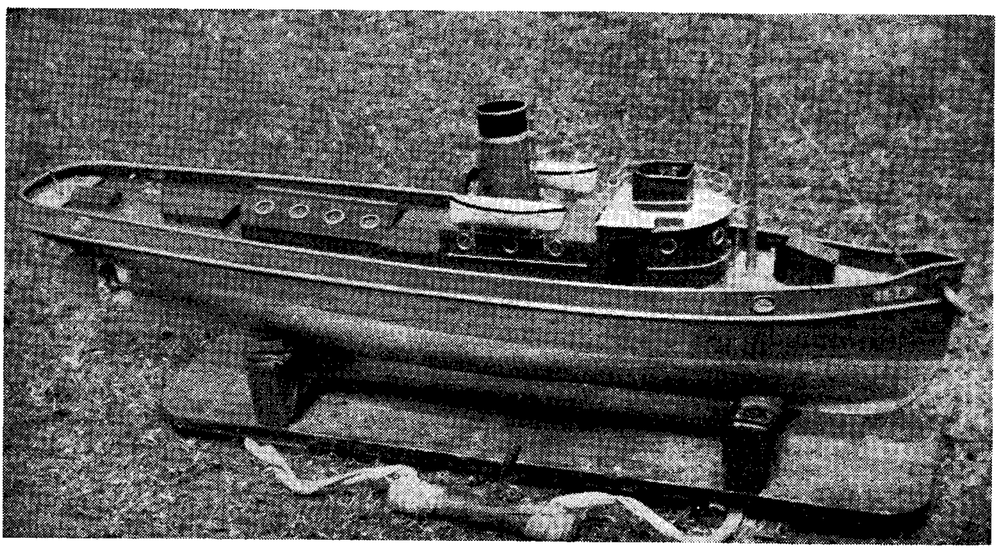
Result:

1st, Mr. Vanner (Victoria), "Leda III," five points.

2nd, Mr. Whiting (Orpington), "Rose Marie," four points.

The final event of the day was a 600-yd. speed contest for A Class boats. A new 30 c.c. petrol job, by Mr. Phillips (S. London), made its first Regatta appearance in this event, causing a lot of interest, as it is fitted with a twin two-stroke.

Mr. Marsh (Southampton), with "Sea Devil III," on both runs, covered the first 3 laps or so at a great pace, but on each attempt petered out badly, although finishing the course; the best time of these two runs was 50 sec. (24.5 m.p.h.).



A new boat by an old hand: Mr. Vanner's petrol-driven tug "Ida." (Query—does it rhyme with "Leda"?

Mr. Pilliner (Guildford), with "Ginger," had exactly the same trouble; incidentally, this petering out, and slowing down business used to be quite common among flash steamers. However, Mr. Pilliner managed to complete one run at an average speed of 26.1 m.p.h.

Mr. Cockman (Victoria), with "Ifit 6," showed flash steam at its best, with excellent performances on both attempts, the faster of the two runs being made at 40.7 m.p.h.

The other flash steamer in the event, Mr. Lynes' "Blitz," seemed to be suffering from engine trouble, and could not return a time.

A Non-Stopper !

Of the petrol-engined boats, Mr. Pinder (Malden), with "Rednip," made an excellent run, just beating "Ifit 6" with 28 sec. for the 600 yds., a speed of 43.7 m.p.h. A lot of amusement was caused when after completing the 6 laps, "Rednip" would not stop after the ignition had been knocked off, and went on for no less than a further 20 laps, although at reduced speed.

Mr. Curwen's unorthodox 3-float hull, now fitted with a 5-c.c. compression-ignition engine, put up a good run in the C class

Mr. Parris (S. London), with "Wasp III," made two good runs, the best speed being 37.2 m.p.h.

Result :

1st Mr. Pinder (Malden), "Rednip," 28 sec. 43.7 m.p.h.

2nd Mr. Cockman (Victoria), "Ifit 6," 30 sec. 40.7 m.p.h.

The hard luck prize this year went to Mr. Jutton (Guildford), running in the B Class event.

The following clubs were represented at the regatta :

The home club, Blackheath, and visitors were Orpington, Malden, N. London, S. London, Southampton, Victoria, Guildford, and Kent Clubs.

And so ended another successful regatta day for the Blackheath club.

A New Type of Miniature Electric Motor

(*Continued from page* 127)

a few hints as to their possible applications in the field of model engineering may be of interest. The tiny type 001 motors open up entirely new possibilities in ultra-miniature powered scale models, as they could be comfortably housed in the tiniest marine or aircraft models hitherto built. Type 240 has a very wide field of usefulness in similar classes of models, and also in miniature electric locomotives of the smallest standard gauges. Tank running of model boats and pylon flying of scale model aircraft, is quite within the range of practical attainment with this motor. The larger sizes of motors are useful for larger model power boats, and their efficiency simplifies the problem of keeping the weight of electrically driven craft within reasonable limits. Any of the motors may be applied to the operation of automatic controls, signalling gear, and other small power requirements.

We have conducted a test on a type 240 "Electrotor," and found that it bears out the claims of the manufacturers in respect of efficiency and economy, working quite well from a $4\frac{1}{2}$ volt pocket dry battery, the current consumption when running light being approximately 0.3 amperes, rising to about 0.45 amperes under load. Means for determining the exact r.p.m. under these conditions were not available, but the makers figure of approximately 5,000 r.p.m. would appear to be reasonably correct. The motor makes very little noise, and is an invariable self-starter from any position of the armature.

"Electrotors" are manufactured by Rev. Electric Motors, Ltd., Knowsley House, Bolton, Lancs., and will be stocked by all leading dealers in model and electrical supplies.

*Electric Locomotives for Passenger Hauling—(5)

by "Milli-Amp"

A SMALL omission in the chassis details has been pointed out by a correspondent, namely that I did not give any information on the axle-box keep plates. I do not think this will have caused much inconvenience to builders, but to clear the matter up, here are the dimensions. Eight pieces of $\frac{1}{4}$ in. by 3/32 in. steel are cut 1.7/16 in. long, and 3/32 in. holes drilled 3/16 in. from the ends of each plate.

Clamp the plates one by one to their respective slots, spot through the holes and drill and tap 7 B.A. for cheese-head screws (or hexagon, if you can get them). The tapped holes will come on the joint between the horncheeks and frame, but this is nothing to worry about.

My reference in the last article to "at least one other 6701 being built," has brought me in a number of letters, from which I note that there are at least a further half-dozen well on the way. This is very interesting and encouraging, especially as one example is a first attempt at any working model.

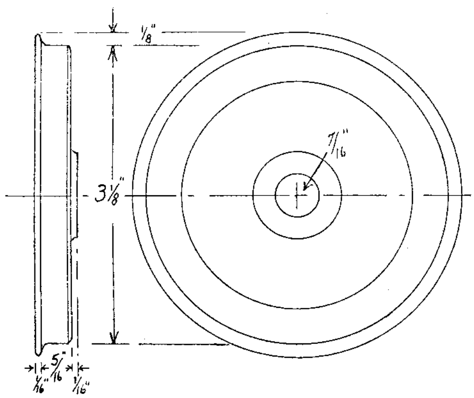


Fig. 14. *Details of wheels*

Wheels and Axles

The wheel castings required should not be difficult to obtain, as they can be normal $3\frac{1}{2}$ in. gauge tender wheels, to finish as near as possible to $3\frac{1}{8}$ in. dia. over the treads. This dimension is not vital and a 1/16 in. or so over or under this will not hurt, so long as all eight wheels are the same. (Fig. 14.)

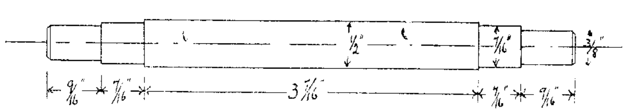


Fig. 15. *Details of axles*

Wheel machining instructions have been given so many times that I will not waste paper by repeating them. In the present case, there are no crankpin holes to set out and drill and the machining is quite straightforward.

The axles are turned to the dimensions shown in Fig. 15. Take care to see that the wheel seats and journals run true with the centre portion of the axles, as it is on this centre portion that the main gearwheel and motor platform is carried and we do not want them to emulate eccentrics!

In my own case, I turned the axles from 9/16 in. dia. steel between centres, with the result that everything runs true, and it doesn't take much longer than using $\frac{1}{2}$ in. stuff and trying to persuade one's self-centring chuck to hold it truly.

The wheels should be a good press fit on their seats, but do not press both wheels home at this stage, as the main gear wheel has to go on first.

Gears

It was my original intention to fit only one motor to each bogie, but as the construction progressed I decided to change my plans and fit a motor to each axle, as on the prototype. There were several reasons for this change, one being that I could not reconcile myself to the idea of using chains and sprockets for taking the drive from the driven axles to the un-driven ones—it did not seem at all correct! Another reason was that as the bogies began to grow, I could see that there was not going to be as much space to spare across the frames as my drawings led me to expect, and this is the factor which limits the length of the motors.

In view of all this, I decided to do the job properly by using individual motor drive to each axle. Some experiments with several types of ex-Service motors (24 v.), showed that the results would justify the means, and I am more than satisfied that other builders will agree that the change is more in keeping with full-size practice.

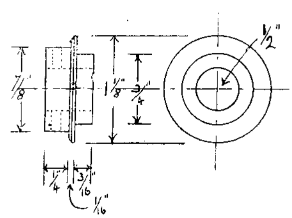


Fig. 16. *Gear bosses* (4 *off*)

With regard to the gears, a ratio of 5:1 or thereabouts appears to be satisfactory, and I have used Bond's 40 pitch brass gears, which are

*Continued from Vol. 96, page 487, "M.E.," April 17, 1947.

3/16 in. wide on face. Using these gears, a 120-tooth wheel comes out at 3 in. dia., which is about the maximum that can be got in with 3⅛ in. driving wheels. A 25-tooth pinion on the motor in conjunction with the above will give practically the correct ratio.

If your driving wheels are on the small side you can use a 100 gear with a 20 pinion. Remember that four pinions and four gears will be required.

The larger gears in this range of Bond's have pressed-in bosses, drilled 5/32 in. To enable them to be used on the ½ in. axles, it will be necessary to press or bore out the existing bosses, bore out the gears, and fit bosses to suit the axles. Details of the new bosses are given in Fig. 16, and it is advisable to take care over the machining in order to ensure concentricity of bore and gear seating.

One way of doing this is to carry out the external and internal work at the same setting and then part off. Alternatively, complete the bore, part off and do the external machining with the job mounted on a mandrel.

Boring out the gears to ¾ in. is best carried out by setting them up in turn, either in the 4-jaw chuck or on the faceplate—they must run true, remember. Make them a nice press fit on the bosses, and in case you have erred slightly and made the four seats on the bosses a thousandth or two under or over, fit each wheel to a boss and then mark them to avoid mistakes later.

Before pressing the two parts together it is just as well to drill and tap the ⅞ in. dia. part of the bosses for 4 or 5 B.A. set-screws, as it will be found that the gear gets in the way when they are assembled. These are shown dotted in the drawing.

Some constructors may like to tin the mating parts and play the blowlamp on them when finally pressing them home, which can be done at this stage.

We will deal with the pinions later, as all that will be required is to open out the existing hole to suit the motor spindles.

Although I have used ready-cut gears there is nothing to stop others from cutting their own if they wish. Excellent articles have appeared in this journal on the subject, and I have nothing to add to them, except to point out that the governing factor as regards choice of pitch, etc., is the diameter of our driving wheels and the ratio required.

(To be continued)

FOR THE BOOKSHELF

The Microscope: its Theory and Applications. By J. H. Wredden, F.R.M.S. (London: J. & A. Churchill Ltd.) Price 21s., postage 6d.

Many books have been written on the microscope and its use, some being of an elementary nature, for the instruction of the beginner, others progressively more advanced; but few books having a more universal appeal to both novice and expert alike, than the one at present under consideration, have been encountered. The author is not only a diligent and enthusiastic practical microscopist, but is also keenly appreciative of the wide and ever-growing field which modern science offers for the application of the microscope. Many people visualise this instrument as a part of the paraphernalia of the traditional scientist, but not all are aware of the part that it plays in the development of literally every modern industry. By no means least in importance is its application to engineering, as is fully brought home by the examples described and illustrated in this book.

Following a historical introduction by W. E. Watson-Baker, which reveals many little-known facts about the development of the modern precision compound microscope from the simple lenses of the early investigators, the author describes the elementary principles of optics, leading up to their application in the several components of the microscope. Chapters dealing with the substage condenser, illuminating systems, the microscope stand and mechanical parts, and the polarising microscope, are followed by others on the use and manipulation of the microscope, photo-micrography, micrometry, preparation of specimens, etc., Reference is made to the modern projection microscope, and some excellent examples are given of the application of the microscope to modern engineering problems. An appendix gives useful tables and data relevant to the subjects dealt with in the book.

Not the least useful feature is the information on bibliography and references, which assist the serious student to delve still deeper into published information on the microscope *and its application.*

The Modern Diesel. (Tenth Edition.) (London: Iliffe & Sons, Ltd.) Price 6s., postage 3d.

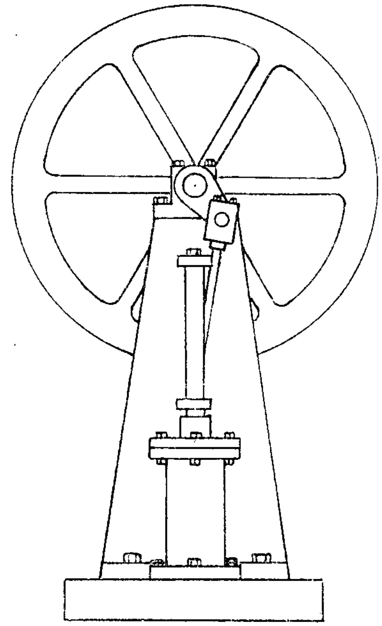
This new edition of a well-known and popular handbook follows up the many developments which have taken place in the design and application of Diesel engines for all purposes during the last few years. Several new British Diesel engines are described, and new information given on technical characteristics and performance; also the tendencies in design of fuel injection equipment and special combustion chambers, cavity pistons, etc. Among the more unorthodox developments in engine design, special interest attaches to such engines as the Hulsebos 5-cylinder axial "wobble-crank" engine, the Sulzer opposed-piston horizontal beam engine, and several types of engines designed to make the best use of available space in modern transport vehicles.

Editor's Correspondence

Model Car Racing Rules

DEAR SIR,—I would like to comment on a letter by Mr. A. L. Steels, quoted by Mr. E. T. Westbury in his recent article " Future Plans."

Mr. Steels writes : " I want the rules altered so as to take the average of, say, three runs with a time limit for starting."



It may be of interest to note that the Pioneer Model Racing Car Club holds an annual Efficiency Competition for the " Westbury Prize," competed for by 5-c.c. and 10-c.c. class cars over a ¼-mile course.

To quote the rules for starting. " To be timed from the *starting* line with *cold engine* ; usual *assistance* for *starting* will be *allowed.* Cars can be prepared for running prior to the event, *engines* must *not* be *run* or *started* prior to *event* at this meeting."

In this recent track event, the time recorded by the winner was an improvement by over 2 min. over the same competition held last year.

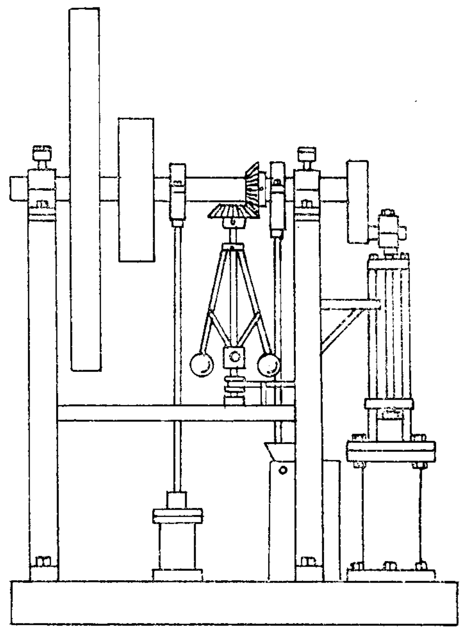
Mr. Steels can see that the " Spiv " racers he refers to are fully aware of the starting limitations of some engines, and have instituted this competition to improve performance.

As the above club caters only for model racing cars I suppose it is logical that our members would be defined by Mr. Steels as " Spiv " racers, but I would like to point out that we have cars in the club that lap consistently without fuss or bother in starting at over 50, and getting very near the 70 m.p.h. ; these cars were designed and constructed by some of the pioneer " Spiv " racers in the country.

Go to it, " SPIVS " !

Yours faithfully,

London, S.W.8. J. W. SULLIVAN.



Old Steam Engines

DEAR SIR,—I am very interested in Mr. S. Lees, of Shaw, Lancs., letter, in the June 12th issue of THE MODEL ENGINEER, about that old steam engine. This type was general for small power plants about the 1860's. I give a sketch I copied from an old book, when I was a boy, about 40 years ago. Had I possessed a lathe I would certainly have made a model of it. It is a pity that the electric motor has taken the place of these small engines. My sketch is very much like that of Mr. Lees' engine. I should like to see many more line drawings of old steam engines from your readers ; also, would some reader give a sketch of the rods which this type of governor, (Watt Pendulum) uses to work the throttle valve, as I am a bit hazy on this particular part.

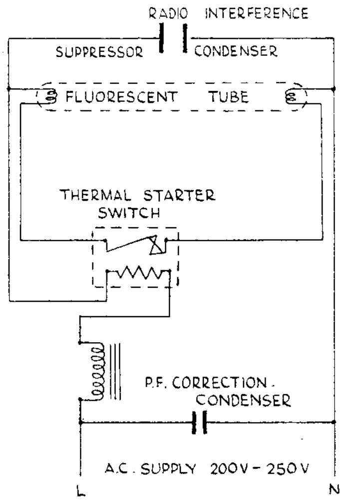
Answering Mr. Lees' query, the engine speed would be 60 r.p.m., working pressure 40 to 50 lb. per sq. in.

Yours faithfully,

London W.14. C. BOVEY.

Fluorescent Lighting

DEAR SIR,—I would like to point out an error made by Mr. J. Smart in his diagram of the fluorescent lamp circuit which was published under Editor's Correspondence in the issue of June 19th. According to his circuit only one electrode heater of the lamp is being supplied with current, the other being a closed circuit on the neutral line. In practice only one electrode would be hot, and, since both are required to be



hot to start the main electron stream, the lamp wouldn't operate. The circuit I give herewith is the correct method of connecting the lamp and gear. You will see that the bimetal strip is in series with the electrode heater's, and the neutral does *not* go direct to the thermal starter switch, as in Mr. J. Smart's diagram.

Yours faithfully,

Manchester. J. SIMPSON.

5-in. gauge G.W.R. 0-6-0 Locomotive

DEAR SIR,—I see my engine was very kindly and favourably commented on by Mr. K. N. Harris in a recent issue.

It may interest readers to know that she did nearly six hours' continuous running on the New Malden club's fine track on June 21st, during the S.M.E.E.'s visit, and the fire was perfectly clear and the engine steaming as freely when she finished as at the start. 22 per cent. cut-off and two-thirds regulator sufficed for any load.

She is quite obviously easily capable of 9 or 10 hours' continuous duty under the hardest conditions, which speaks volumes for the work of Mr. J. N. Maskelyne the designer and F. Baldwin the builder, as well as the G.W.R. lubrication of valves and pistons, the steam brake, correct controls and working-sand gear which my good friend Mr. W. B. Hart so kindly fitted.

I am proud to think that she has on her personal work, for which I am indebted to good friends who are numbered among the finest model engineers of their time :—

Drawings by Mr. J. N. Maskelyne ; Injectors by Mr. Linden and Mr. Keiller ; R. H. tender tool box and auxiliary oil boxes by Mr. V. Storey ; L.H. tender tool box and padlock, lubricator, cab mountings, steam brake, 2 whistles, painting and lining and much detail work by Mr. W. Barnard-Hart.

I would like to thank all these friends for a fine job achieved by willing help most generously given.

Spare injectors have been provided most kindly by Messrs. Linden and Keiller, which means that it is but a few minutes work to change either should a cone choke while working, Mr. Hart having piped them in such a way as to render removal easy.

Yours faithfully,

Newton Abbot. A. J. MAXWELL.

Small Steam Turbines

DEAR SIR,—I was very interested to read Mr. Walter Elkin's letter in your issue of May 29th, especially with regard to stroboscopic methods of speed measurement. It may not be generally known that the fainter of the two flashes produced by a neon lamp per cycle on A.C. mains, may be eliminated by superimposing a suitable direct voltage on the alternating voltage, and so reducing one half wire below the striking voltage of the lamp. The lamp will then flash only 3,000 times per minute.

A suitable circuit which requires a 2:1 mains transformer is shown in Fig. 1.

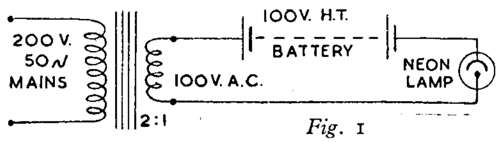


Fig. 1

Should a 2:1 transformer not be available, a suitable potential divider could be constructed by using two similar 100-volt lamps connected in series across the supply mains as in Fig. 2.

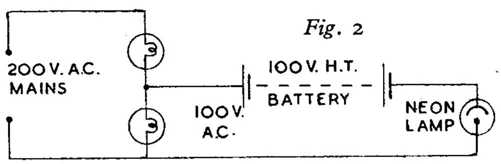


Fig. 2

If 100-volt lamps were not available two similar 200-volt lamps would most likely allow the neon lamp to function quite well. If I were at home I would try this out first before writing. In any case, the neon lamp should be tried both ways round in the holder, as one position will give the brighter flash. In using a potential divider, care should be taken against shock, as the bottom connection may have the full voltage to earth.

Too accurate reliance should not be placed on the frequency of the supply mains. I do not know what the variation is now, but during the war the frequency must have varied between about 48 and 52 cycles per second, judging by the amount electric clocks sometimes gained during the night.

Yours faithfully,

Carlisle. J. F. PERRIN.